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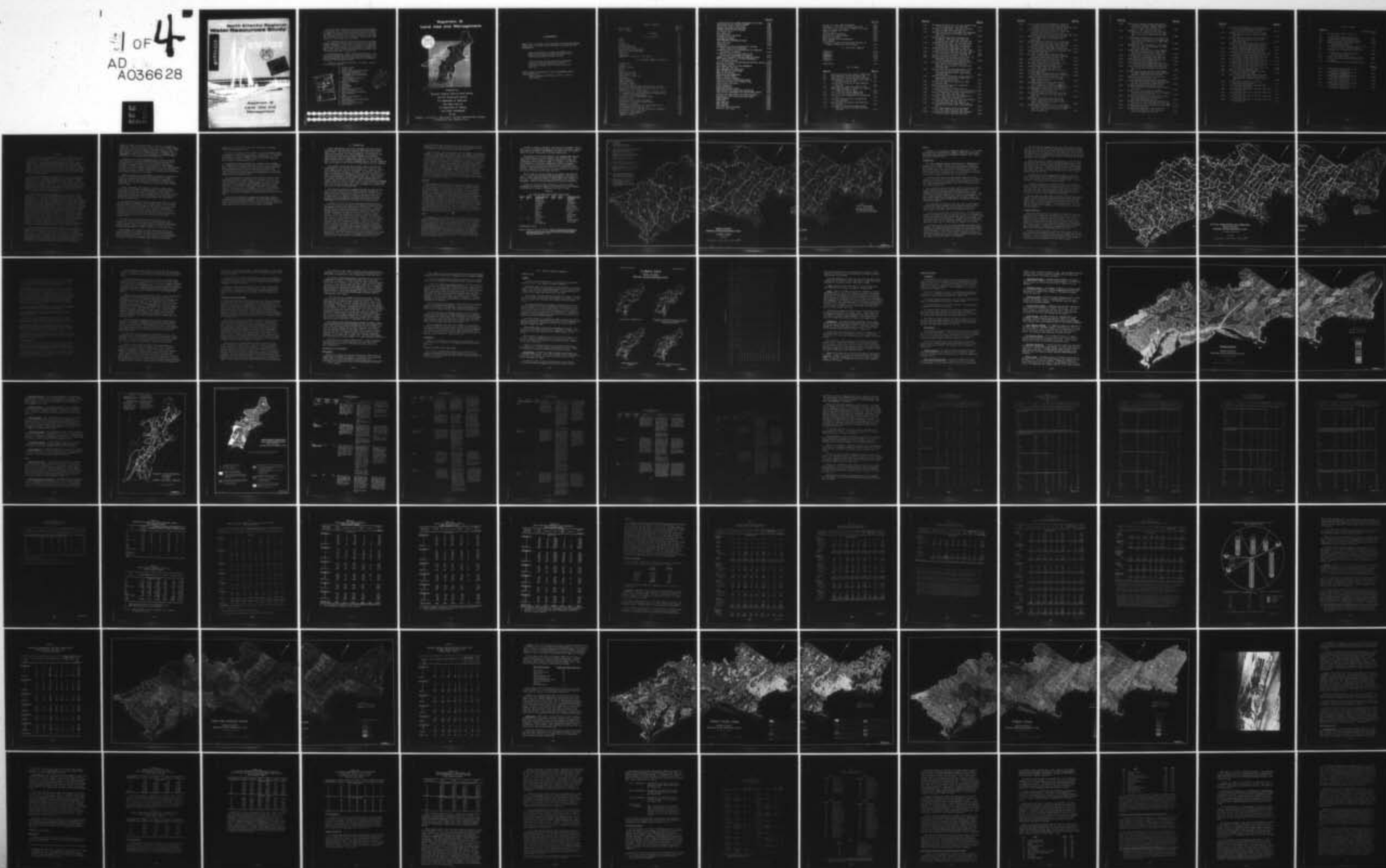


North Atlantic Regional Water Resources Study

NAR

Appendix G
Land Use and Management

The North Atlantic Regional Water Resources (NAR) Study examined a wide variety of water and related land resources, needs and devices in formulating a broad, coordinated program to guide future resource development and management in the North Atlantic Region. The Study was authorized by the 1965 Water Resources Planning Act (PL 89-80) and the 1965 Flood Control Act (PL 89-298), and carried out under guidelines set by the Water Resources Council.

The recommended program and alternatives developed for the North Atlantic Region were prepared under the direction of the NAR Study Coordinating Committee, a partnership of resource planners representing some 25 Federal, regional and State agencies. The NAR Study Report presents this program and the alternatives as a framework for future action based on a planning period running through 2020, with bench mark planning years of 1980 and 2000.

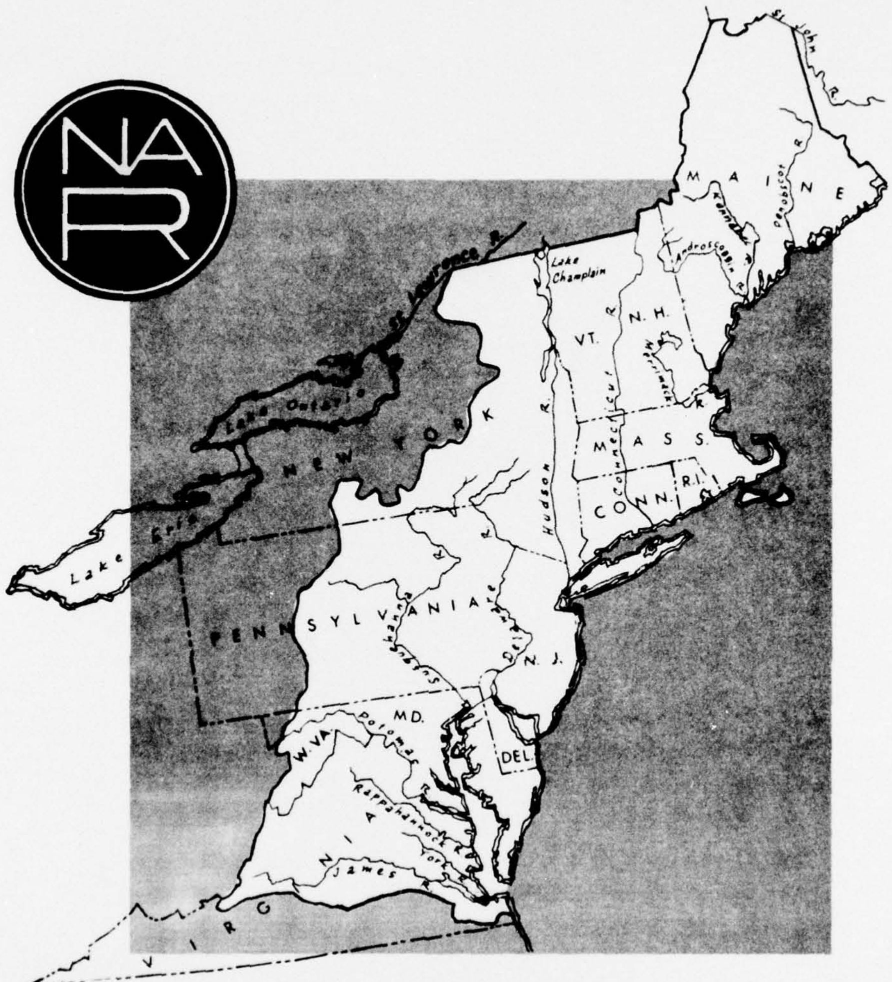
The planning partners focused on three major objectives -- National Income, Regional Development and Environmental Quality -- in developing and documenting the information which decision-makers will need for managing water and related land resources in the interest of the people of the North Atlantic Region.

In addition to the NAR Study Main Report and Annexes, there are the following 22 Appendices:

A. History of Study
B. Economic Base
C. Climate, Meteorology and Hydrology
D. Geology and Ground Water
E. Flood Damage Reduction and Water Management for Major Rivers and Coastal Areas
F. Upstream Flood Prevention and Water Management
G. Land Use and Management
H. Minerals
I. Irrigation
J. Land Drainage
K. Navigation
L. Water Quality and Pollution
M. Outdoor Recreation
N. Visual and Cultural Environment
O. Fish and Wildlife
P. Power
Q. Erosion and Sedimentation
R. Water Supply
S. Legal and Institutional Environment
T. Plan Formulation
U. Coastal and Estuarine Areas
V. Health Aspects

WATER RESOURCES NEEDS AND POTENTIALS FOR AN EXPANDING SOCIETY

Appendix G
Land Use and Management



Prepared by Wash D C

Economic Research Service, Forest Service
and Soil Conservation Service
U. S. Department of Agriculture
with Major Input by
U. S. Department of Housing
and Urban Development
for the

NORTH ATLANTIC REGIONAL WATER RESOURCES STUDY
COORDINATING COMMITTEE

ACKNOWLEDGMENTS

Major inputs to Appendix G were provided by the following reports prepared for the United States Department of Housing and Urban Developments:

Study of Alternatives in Urban Development in the North Atlantic Region prepared by Ralph M. Field, Planning Consultant, New York, New York.

Study of Present and Projected Urban Development and Land Use in the North Atlantic Region prepared by Regional Plan Association, New York, New York.

Visual Quality Constraints for Linear Programming Analysis were provided by:
Research Planning and Design Associates, Amherst, Massachusetts.

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I - SYLLABUS

The land form of the North Atlantic Region (NAR) is best characterized as low mountainous ridges separated by narrow fertile valleys which lead to coastal plains with tidal streams. The northern half was glaciated, creating many lakes and enriching the valley floors. Abundant rainfall throughout the entire Region provides a vegetative cover consisting primarily of forest. The sharply contrasting seasons of the year with accompanying temperature changes provide a wide variety of vegetative types and color. The length of growing seasons varies widely from 100 days in the north to 200 days in the south.

The varying topography is further enhanced by the forest being interspersed with cropland and pastures, city and town. However, the landscape is increasingly subjected to man's impact. Eighty percent of the Region's approximately 50 million people live on 6 percent of the Region's land area. They traverse the Region through interconnecting transportation corridors. The rapidly expanding population and associated land requirements compete with agriculture for the higher capability (more productive) land which makes up less than 40 percent of the total land area.

The NAR is the most densely populated area of its size in the United States, with a regional population density of 264 persons per square mile. In 1960, the Region had approximately 25 percent of the nation's people but only about 5 percent of its land resources. Concentration is expected to continue with rural population, although increasing in absolute numbers, experiencing a continued decline in its share of the total population. While farm population is declining rapidly, rural nonfarm population is on the increase. These population shifts contribute greatly to continuing land use changes which must be planned in view of the limited land resource base. Given wise land use and management, the agricultural industry can remain viable in spite of the economic squeeze due to the extreme competition for land and labor resources. The loss of acreages for the production of crops has been compensated by increased yields through improved technology. Although acreage used in agriculture will continue to decline, intensity of agriculture will continue to increase. Management of the soil resource will improve, resulting in modest increases in income to fewer farmers on fewer farms.

It seems somewhat incongruous that two-thirds of a region so populated remains forested. Its forest area is exceeded by that of only two other framework study areas in the nation. The forest lands provide a variety of goods and services in the form of water, wood, wildlife and recreation, and are an important component of our environment. Problems commonly associated with small areas of privately-owned forest land, principally an unsatisfactory level of management and protection, must be alleviated if the projected

demand for forest goods and services is to be met. Occupying as they do the steepest, thinnest, poorest soils in the Region, forests provide the stabilization needed to hold these soils in place, while receiving and releasing the greater part of the Region's fresh water supply. Initiation or intensification of management must be implemented if these values are to continue to be realized under conditions of increasing pressures for other uses.

Flooding, erosion and sedimentation, water quality, sanitary landfill, mining excavation and deteriorating visual quality of the landscape are problems which can, to a great extent, be ameliorated through accelerated conservation and land treatment programs. When lands undergo rapid changes in use, the above problems are aggravated unless intensive management and care are exercised. Programs are needed to control erosion in expanding urban areas where high sediment production is occurring.

About 38 million acres, representing 35 percent of land area in the NAR, are adequately treated or are not feasible to treat. A program of conservation measures and treatment is suggested to adequately treat an additional 13, 19 and 17 million acres by the years 1980, 2000 and 2020 to maintain or improve the land resources of the Region.

Linear programming (LP) analysis of land use shifts reveals there need be no shortage of land resources to meet the projected requirements for food and fiber in the Region. There may be a deficiency after the year 2000 of acreage to meet the specified needs in the higher capability classes resulting in necessary shifts of production to the lower classes (poorer lands) and subsequently greater production costs.

The analysis found that a land use pattern that fulfilled visual quality standards recommended for the region would cost an average $4.34 more per acre than for land use that would result in the most efficient agricultural production. To reach the environmental objective and also maintain the current output of food and fiber, an additional 164,000 acres of cropland and pasture, 16.7 million additional acres of forest land and 752,000 additional surface acres of water would be pressed into use from idle and other under utilized land.

In spite of anticipated urbanization ranging from 10 to 17 million acres in the region by the year 2020, sufficient land is available to meet production requirements, environmental enhancement, and development. What is required, however, is sound land use planning and management in order to achieve all of the objectives.

Urban growth will continue to spread outward and between the Region's central cities which were long ago established along the major waterways and estuaries. The prospect of 40 million additional people in the NAR between 1960 and 2020, simply as an extension of the present pattern of settlement, may be expected to increase

exponentially the multiple crisis now confronting the Region's cities and metropolitan areas.

Of specific interest to this Appendix is the two magnetic poles of urban life, urbanity and open space. Opportunities for extending the benefits of urban development and/or redevelopment can arise with high net densities, affording urbanity, and relatively low gross densities, affording open space.

Comprehensive urban planning is an essential tool to manage the complex land use changes required in both the city and suburban areas. Only major innovations in both the development design and the development process can secure and enlarge upon the more traditional values of ownership, privacy and mobility. Issues of land use and disposition are central if metropolitan form and urban pattern are to be improved upon.

The juxtaposition of urban and rural land use provides a most interesting and high visual quality to the beholder. It is also the most difficult to retain. Emphasis must be accorded to means for improving and advancing land development practices. Although primarily a local problem in that counties, municipalities and towns regulate and control development activities, only through regional coordination can the individual controls become effective. Problems of an institutional nature probably outweigh those of a physical, social and environmental nature related to land use in the NAR.

Despite wide variation in landform and topography, physical features offer few serious constraints to development between the Appalachians and the Atlantic margin. Hence, the future "shape" of urban settlement in the NAR will be determined by man-made decisions rather than by any imperatives of the natural environment.

II - INTRODUCTION

Urban, agricultural, and forest activities are the principal contenders for land and water resources within the North Atlantic Region (NAR). For agriculture and forestry, land represents a factor of production. Soil type and quality, in association with other physical properties, directly influence the parameters governing crop yield and farm output. In the creation of urban space, however, land is significant primarily as a site upon which more or less space is "produced" depending upon the type of structures that are erected and their pattern of distribution over the landscape.

The analysis of land use which follows clearly indicates that an abundance of land is physically available in relation to the total demands placed upon the land resource base. However, a definite distributional problem is evidenced. In addition, institutional constraints and rigidities result in much of the land resource base to be unavailable for general or specific use. Since land is not a mobile resource, land use change is the only practical means of relating availability to demands. Given necessary land use change, analysis of rate of change in land use in response to changing demands placed on the land resource base is required to lend guidance and assure the land resource base can be utilized to its highest and best use over space and through time.

The evidence presented in Appendix B distinctly shows that the North Atlantic Regional Water Resource Study Area encompasses a highly industrialized and urban oriented society. Within the next 50 years the NAR is expected to double in population and area of developed land. The quality of life that will result from this growth could vary enormously, depending upon public and private development decisions that will be made in the coming decade.

Although vast areas of sparsely populated forested and agricultural lands exist in the region, the dominant influence on land use emanates from the metropolitan areas which desire to share in the use of these lands for such purposes as recreation, transportation, mineral and water production in addition to normal food and fiber production in order to enhance the overall quality of society. Therefore, location of a variety of land use within a day's drive of a major metropolitan area increases both quality and alternatives available to the users. However, this does change the course of planning since isolation of land uses such as agricultural, forested, recreational, urban, or other specific uses in separate areas of the region, even though proven most efficient from a production viewpoint, would be an unacceptable alternative due to the great loss in readily available contrast and quality of the environment. Fortunately much of this problem is circumvented by the natural geographical distribution of different kinds of qualities of land, water and mineral resources throughout the region. Nevertheless, it still remains to determine alternatives approximating the most efficient and yet acceptable mix of land use

considering both land capability and demands placed upon the land resource base in order to develop land use and management policies and programs to more fully develop the land resource.

Much of today's land use resulted from the demands of yesteryear. Communities have grown from stockades with surrounding open space consisting of garden type agriculture within natural forested areas to large metropolitan areas having relatively little open space in close proximity to the cities or the transportation corridors. The cities and transportation corridors have developed in areas most suitable to agriculture due to low development costs associated with such lands. Until the middle of this century, enough good land was available to preclude problems of great magnitude. However this is no longer the case since development extends into many of the good agricultural valleys of the NAR. Further, projections indicate a similar pattern of development at an accelerated pace. Therefore, planning of water and related land resource use is a rational and necessary requirement for maintenance and improvement of the environment of an urbanized society.

PURPOSE

This Appendix addresses itself to the identification of land capabilities and their location in relation to changing demands. It also identifies the constraints to land use shifts in response to changing demands or a more efficient and/or acceptable distribution of land use. Projections are presented of the changing demand and changing availabilities with and without planned land use changes. In addition, several analyses of the above parameters are presented to identify the various capabilities of the land resource base to provide for the demands placed upon the resource. As shown in the syllabus and chapters to follow, the varying capabilities under alternative assumptions expose problems and solutions about the ability of the land resource base within the NAR to meet the requirements thrust upon it. Current programs are briefly discussed along with their limitations. Capabilities of management programs are assessed leading to recommendations of policies and programs found in the main report.

SCOPE

The geographic area encompassed by the NAR Study includes all river basins draining into the Atlantic Ocean north of the Virginia-North Carolina state border, including Chesapeake Bay, the Lake Champlain drainage within the United States, and the St. Lawrence River drainage south of the junction of the St. Lawrence River and the international boundary. The States of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New Jersey, Delaware, the District of Columbia and portions of the States of New York, Pennsylvania, Maryland, West Virginia and Virginia are included within the study area boundaries. Subregions, Areas and Basins are shown on Figure G-1.

The NAR is roughly 1,000 miles long from the northernmost tip of Maine to the southernmost boundary of the James River Basin. Extending inland an average of approximately 200 miles from the Atlantic Coast, it covers a land area of 167,456 square miles.

For purposes of urban area analysis, the Regional Plan Association (RPA) designated, as the Atlantic Urban Region (AUR), a 263 county area, which included 17 counties outside of the NAR and excluded 25 counties within the NAR - 11 in Maine, 4 in New York, 10 in Virginia - as well as 4 independent cities in Virginia. (Table G-1) This created only minor problems in population and land area conformity between the NAR and the AUR since the latter, in 1960, contained 97.8 percent of the total population within the NAR, and 76.8 percent of its total land area.

Of the 23 Water Resource Planning Areas (WRPA) those numbered 1, 8, 11, and 21 were excluded from consideration as was part of WRPA 2. Hence, the AUR includes 19 entire WRPA's and a portion of one other. The WRPA's were further disaggregated into 55 Urban Subregions. WRPA's and Urban Subregions are shown in Figure G-1a.

History, resource base and capabilities, land use, trends, management and treatment, demands, and alternatives to meet demands are presented in degree of refinement of a Type I study.

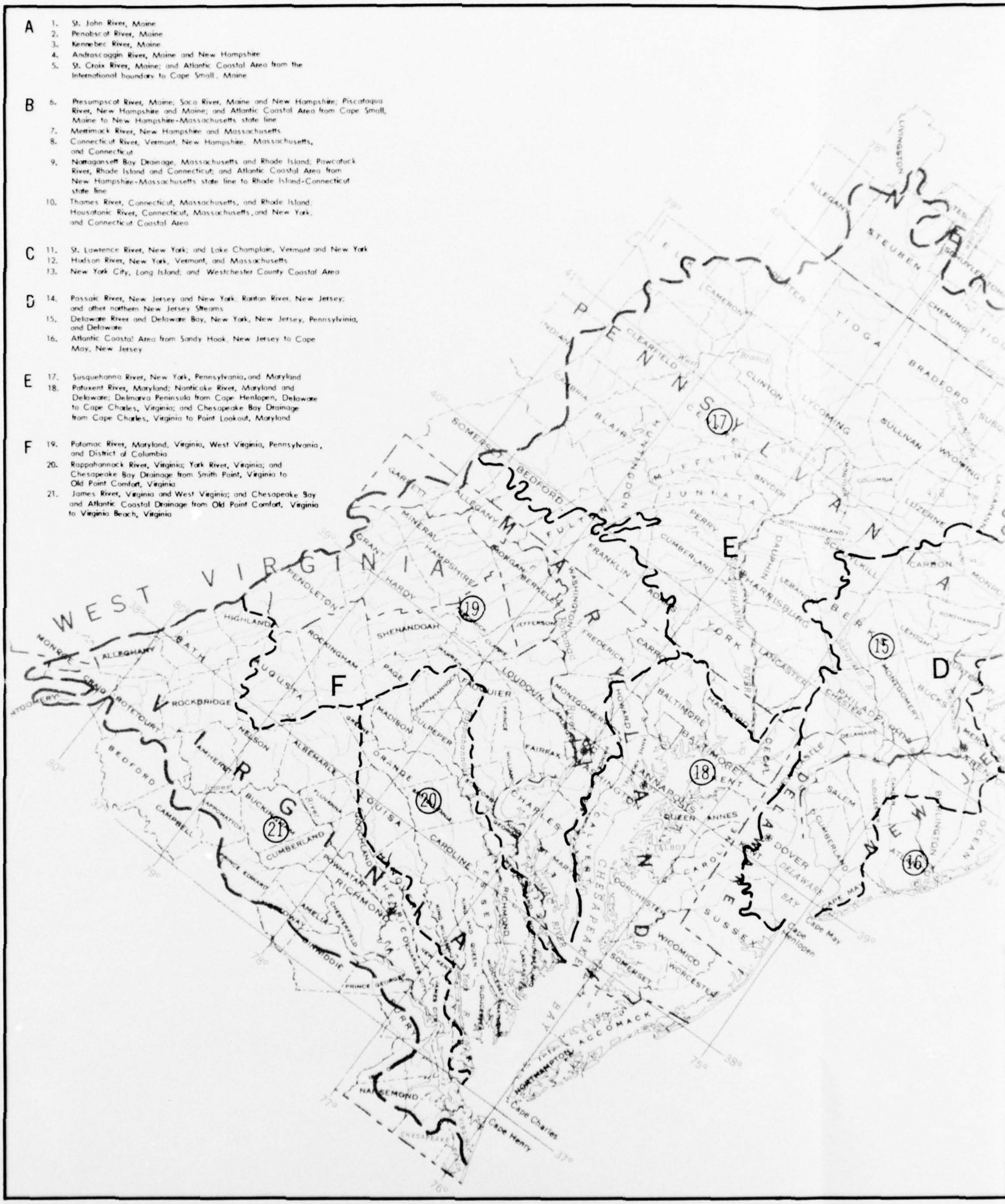
TABLE G-1

NAR AREAS EXCLUDED FROM ATLANTIC URBAN REGION

AREAS	STATE	COUNTY OR CITY	AREAS	STATE	COUNTY OR CITY
1	Me.	Aroostook	21	Va.	Alleghany
2		Penobscot			Amherst
		Piscataquis			Appomattox
3		Franklin			Botetourt
		Somerset			Buckingham
4		Oxford			*Buena Vista
5		Hancock			*Clifton Forge
		Knox			*Covington
		Lincoln			Craig
		Waldo			Cumberland
		Washington			*Lynchburg
11	N.Y.	Clinton			Nelson
		Essex			Prince Edward
		Franklin			Rockbridge
		St. Lawrence			

*Independent Cities

Source: Regional Plan Association, Study of Present and Projected Urban Development and Land Use in North Atlantic Region (Preliminary Issue), p. 100.


A 1. St. John River, Maine
2. Penobscot River, Maine
3. Kennebec River, Maine
4. Androscoggin River, Maine and New Hampshire
5. St. Croix River, Maine; and Atlantic Coastal Area from the International boundary to Cape Small, Maine
B 6. Presumpscot River, Maine; Saco River, Maine and New Hampshire; Piscataqua River, New Hampshire and Maine; and Atlantic Coastal Area from Cape Small, Maine to New Hampshire-Massachusetts state line
7. Merrimack River, New Hampshire and Massachusetts
8. Connecticut River, Vermont, New Hampshire, Massachusetts, and Connecticut
9. Narragansett Bay Drainage, Massachusetts and Rhode Island; Pawcatuck River, Rhode Island and Connecticut; and Atlantic Coastal Area from New Hampshire-Massachusetts state line to Rhode Island-Connecticut state line
10. Thames River, Connecticut, Massachusetts, and Rhode Island; Housatonic River, Connecticut, Massachusetts, and New York; and Connecticut Coastal Area
C 11. St. Lawrence River, New York; and Lake Champlain, Vermont and New York
12. Hudson River, New York, Vermont, and Massachusetts
13. New York City, Long Island; and Westchester County Coastal Area
D 14. Passaic River, New Jersey and New York; Raritan River, New Jersey; and other northern New Jersey Streams
15. Delaware River and Delaware Bay, New York, New Jersey, Pennsylvania, and Delaware
16. Atlantic Coastal Area from Sandy Hook, New Jersey to Cape May, New Jersey
E 17. Susquehanna River, New York, Pennsylvania, and Maryland
18. Patuxent River, Maryland; Nanticoke River, Maryland and Delaware; Delmarva Peninsula from Cape Henlopen, Delaware to Cape Charles, Virginia; and Chesapeake Bay Drainage from Cape Charles, Virginia to Point Lookout, Maryland
F 19. Potomac River, Maryland, Virginia, West Virginia, Pennsylvania, and District of Columbia
20. Rappahannock River, Virginia; York River, Virginia; and Chesapeake Bay Drainage from Smith Point, Virginia to Old Point Comfort, Virginia
21. James River, Virginia and West Virginia; and Chesapeake Bay and Atlantic Coastal Drainage from Old Point Comfort, Virginia to Virginia Beach, Virginia
WEST VIRGINIA
VIRGINIA
MARYLAND
PENNSYLVANIA
DELAWARE
NEW JERSEY
CHESAPEAKE BAY
Cape Charles
Cape Henry
Cape May
Cape Henlopen

NORTH ATLANTIC
REGIONAL WATER RESOURCES STUDY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

October 1968

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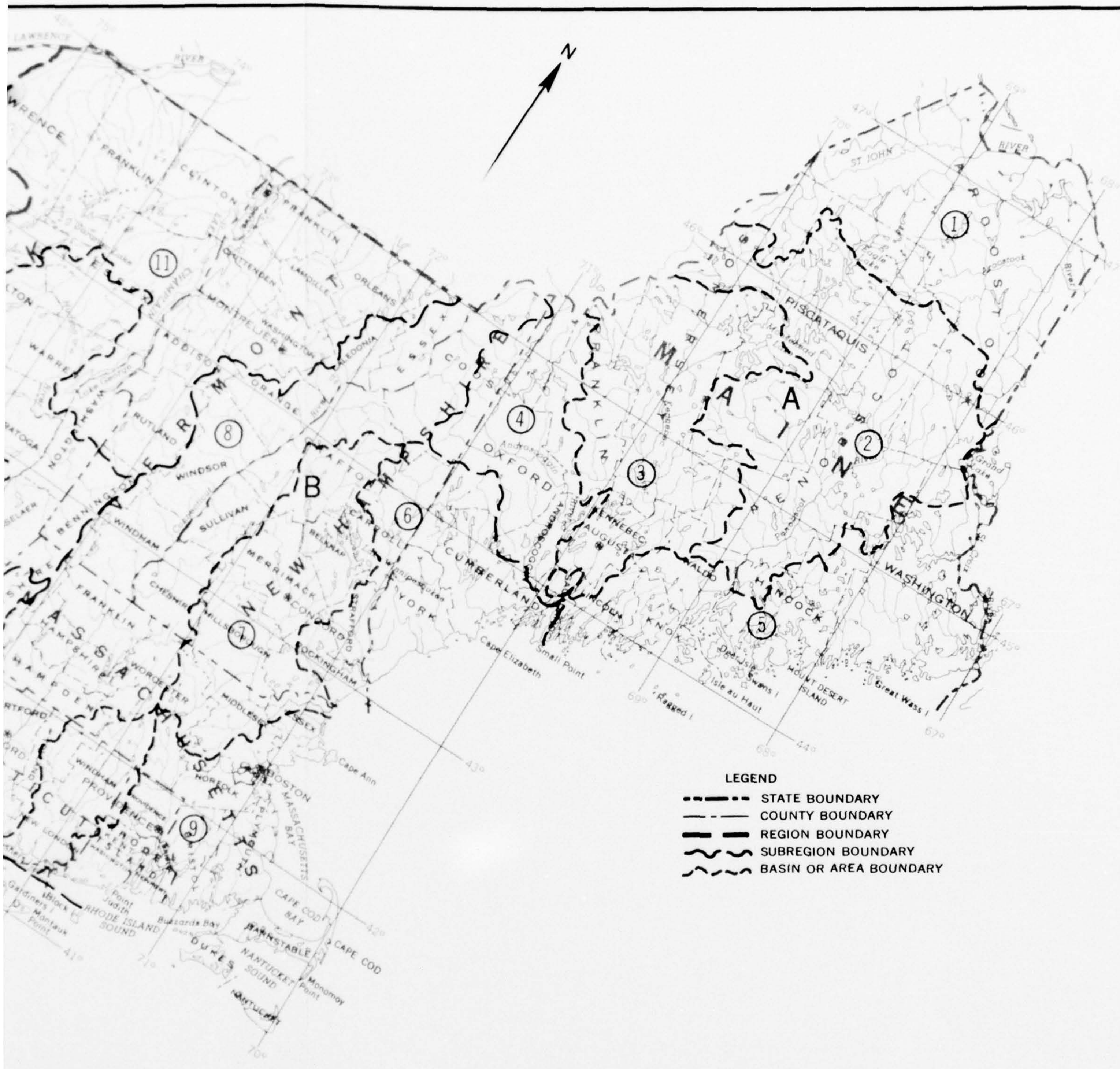

STUDY

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FIGURE G-1

USDA-SCS-HYATTSVILLE, MD. 1970

HISTORY

The NAR is the birthplace of American Agriculture. It is therefore important to understand the impact of land use, and to summarize the major actions and technological advances which lead to our present resource base.

Colonial Era

The first permanent English settlement was at Jamestown, Virginia in 1607; followed shortly by the settlement at Plymouth, Massachusetts in 1620. Inland urban centers became established as villages in the valleys of the chief navigable rivers: the Thames, the Hudson, the Connecticut, and the Delaware. South of the Chesapeake Bay, population also clustered along the waterways but in a more dispersed pattern than in the North.

From a few port cities and their nearby towns in the 17th century, the present AUR has evolved into a continuous high density area with the bulk of the population distributed in and around the coastal metropolises of Boston, New York, Philadelphia, Baltimore, and Washington D.C.

The colonists brought with them a general knowledge of agriculture and methods of crop rotation used in Europe. After an initial period of adjustment they were finally able to raise sufficient agricultural products to satisfy their own needs. Land was the most plentiful resource and it was used extravagantly. It was treated almost as a free good and it was spent freely. In every case a quick return was desired at the smallest expenditure of labor and capital.

In New England an infertile soil and a more severe climate diverted some of the energies of the colonists from agriculture into fishing, lumbering, shipbuilding and fur-trading; but agriculture was the most necessary and important industry.

The raising of food crops was threatened by the introduction of tobacco in Virginia in 1612 by John Rolfe. With the development of a new curing method and the overwhelming demand, the settlers turned with one accord to raising tobacco. So great was the demand that the forest could not be cleared fast enough; and in 1617 even the roads and market place of Jamestown were planted with tobacco.

As in the case of corn, the Indian method of cultivation was adopted. The forest was partially cleared and burned and tobacco was planted continuously until the virgin soil was exhausted; then it was abandoned. Fields lasted from three to eight years. This type of agriculture made southern farmers essentially migratory, and large acreages of land were needed. Southern farms were large as opposed to the small farms in New England.

The less rigorous climate and the more fertile and less stony soil of the middle colonies made agriculture the dominant industry. The settlers arriving in later years introduced more skillful and thorough measures and exhibited the best agriculture in the colonies. The newer concepts of agriculture were also evident on the land for it was more freely prepared, better plowed and cultivated, and farm implements were improved.

Crops were similar to those of New England but more attention was given to oats, wheat, rye, barley and buckwheat than to corn. So great was the production that the middle colonies were called the "bread colonies". In addition to the grains, white potatoes and fruits flourished. Livestock brought in by the Dutch, Swedes and Germans were soon to be found in large herds in New Jersey, Pennsylvania and New York.

The agriculture of New England and the middle colonies was on a self-sufficient basis, providing the farmer with all his basic needs except salt and iron. The northern farmer "lived on his own" in the spirit of the colonial period.

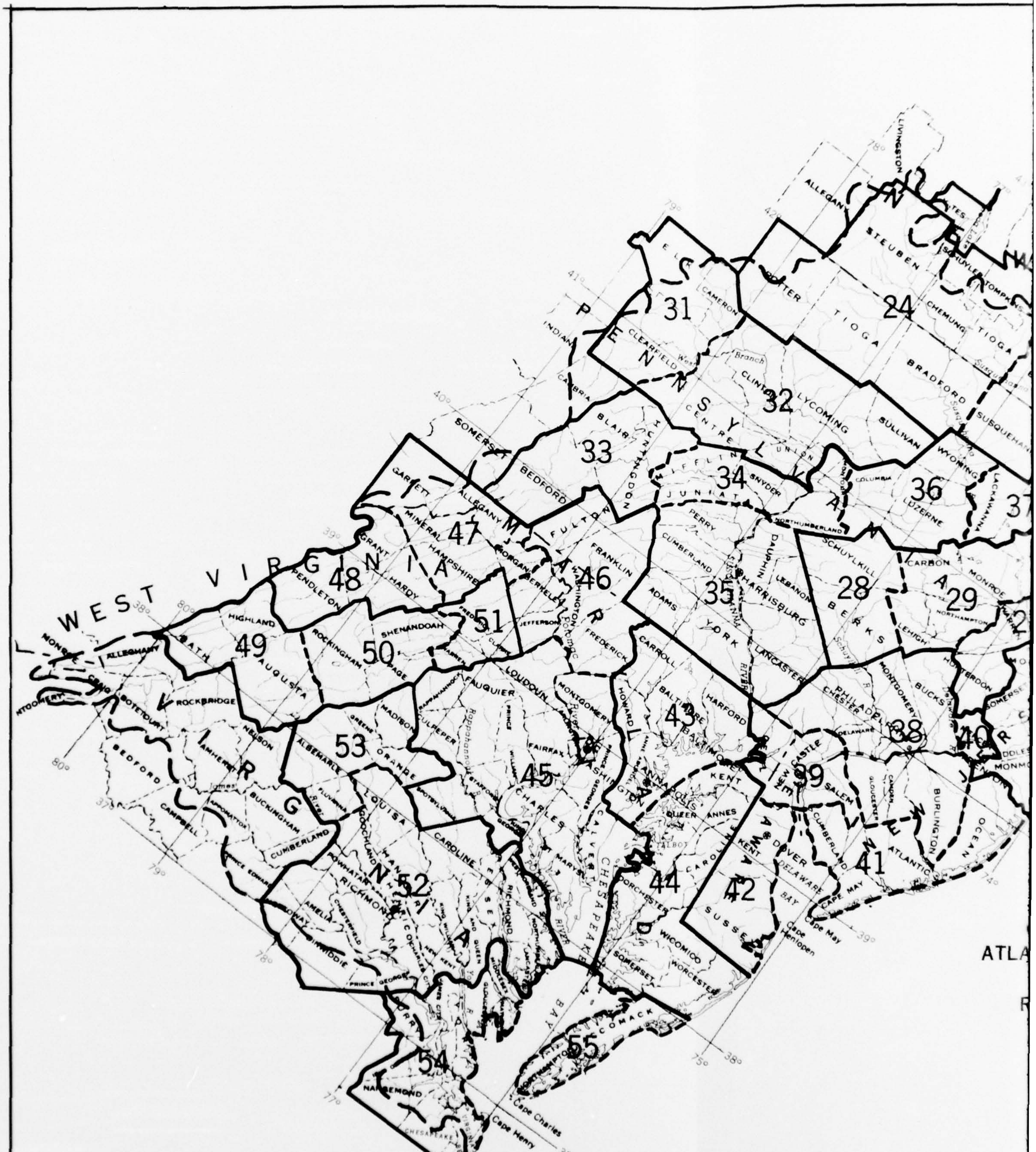
In general the Atlantic coastline provided a good seed bed; only in New England was early settlement limited to a narrow belt along the coast. Because of the stony character of the soil and the high labor input and small profit, farms were small. The high labor and small profit character of New England farms also turned the settlers to more profitable occupations.

Farther south the large tracts of fertile land and more amiable climate invited cultivation of profitable crops by the exhaustive method. Had the land been limited the southern colonists might have found it necessary to practice crop rotation and fertilization as done by English methods. This exhaustive type of agriculture gave impetus to the spread of civilization west to the Appalachian Mountains.

Colonial Industries

One of the main motives of colonization of America was to provide the mother country with the necessary articles for which she depended on other countries. Men were imported from all over Europe to develop manufacturing in the colonies. The early settlers were therefore miners, artisans and tradesmen rather than farmers. In general the two dominant influences which determined the colonial course of action were the unlimited natural resources and a ready market. In Virginia the demand for tobacco made futile the development of manufacturing in that area.

The most prevalent natural resource was the forest; it was almost inexhaustible, readily accessible and the product was easy to transport. A large and steady market existed in Europe due to overcutting of domestic supplies which threatened the iron, tanning, shipbuilding and wood industries of the mother country.


WEST VIRGINIA
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MARYLAND
VIRGINIA
DELAWARE
NEW JERSEY
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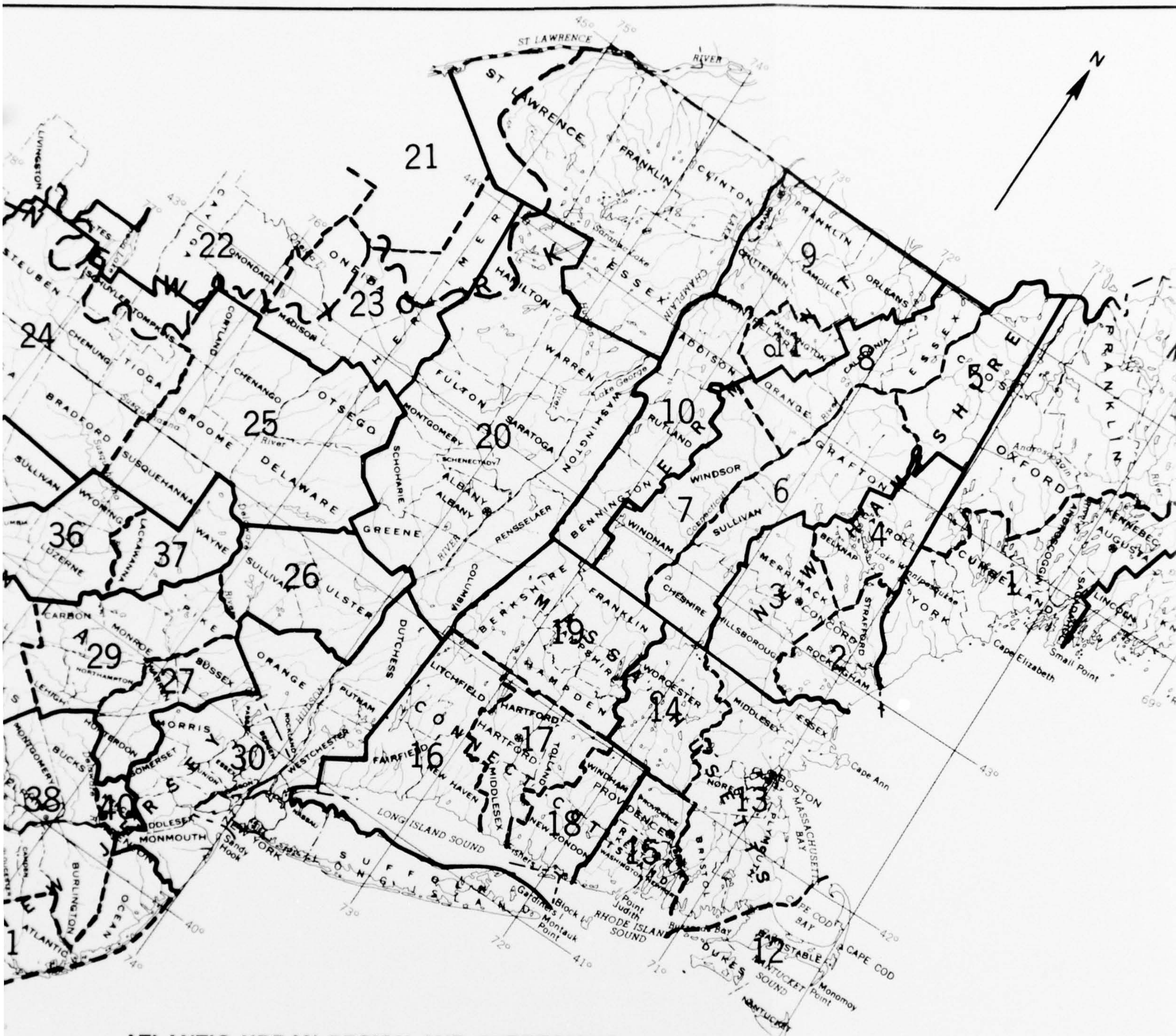
CHESAPEAKE
BAY
Cape May
Cape Henlopen
Cape Charles
Cape Henry
ATLA
SOURCE: Regional Plan Association 1968



ATLANTIC URBAN REGION AND SUBREGIONS
NORTH ATLANTIC
REGIONAL WATER RESOURCES STUDY

U. S. DEPARTMENT OF AGRICULTURE

October 1968

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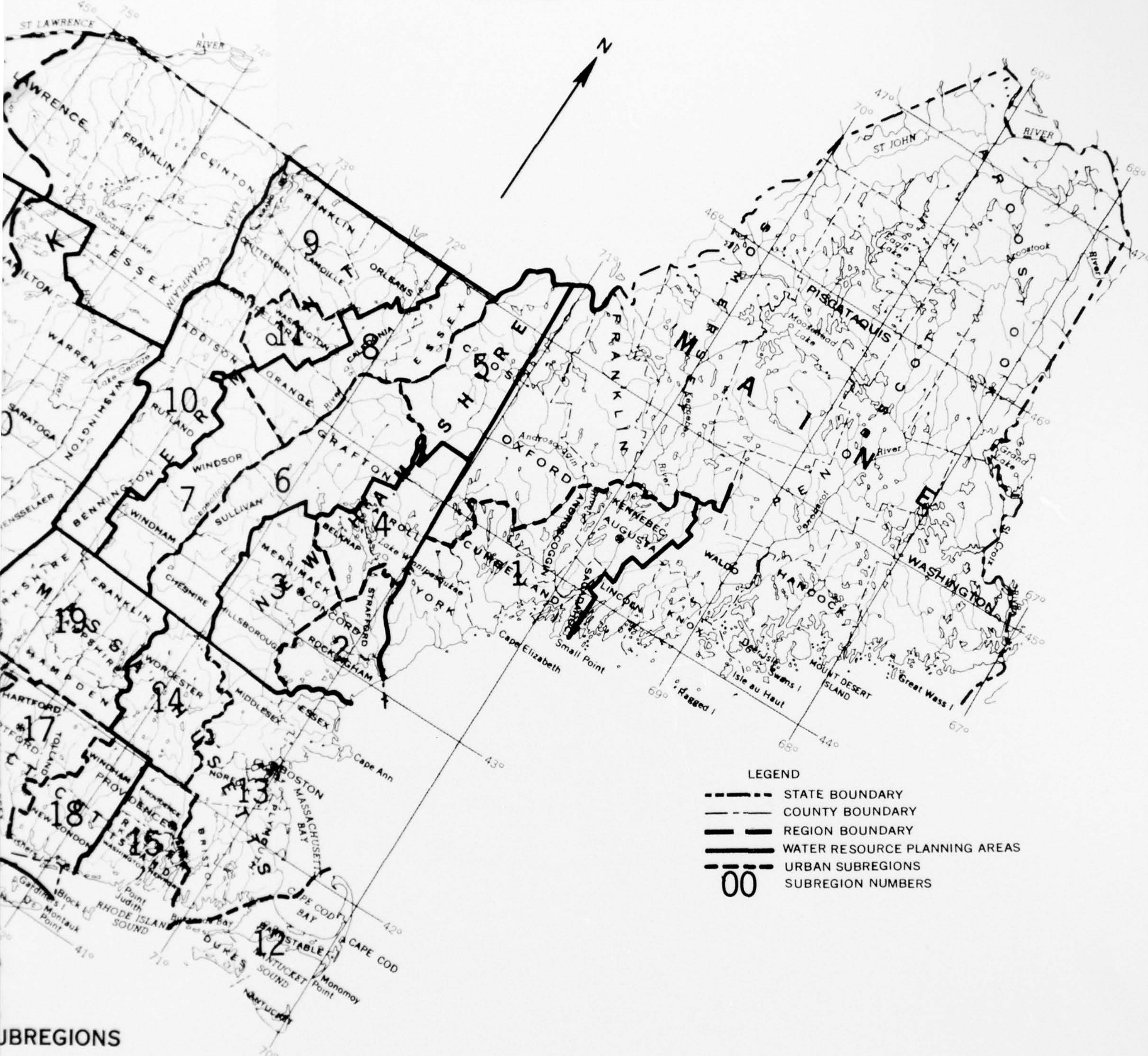

UBREGIONS

S STUDY

100 Miles

3

FIGURE G-1a

USDA-SCS-HYATTSVILLE, MD. 1971

In order to utilize the forest resource, sawmills were established throughout the colonies along the main river courses. The first sawmill is believed to have been established near York, Maine, in 1623. By 1723 the Piscataqua River in New Hampshire had more than 70 water powered sawmills, turning out over 6 million feet of planks and other forest products per year.

While Virginia developed a flourishing economy based on tobacco, trade and manufacturing provided the impetus for the growth of cities in the Northeast. Given the prevailing mercantilistic philosophy, the cities were initially organized as economic outposts of the mother countries, England and Holland. Exports to Europe consisted of forest products, timber and naval stores, grain and flour, and oil from whales and codfish caught by New England fishermen off the coast of Newfoundland. The cities attracted craftsmen, and industry linked to sea trade began to develop. Early industries were shipbuilding and outfitting, flour-milling, rum-making, and food preservation. Later ironworks developed in all the colonies, together with metal smelting and refining, largely to serve the shipyards and construction industry which had developed in Boston, New York, and Baltimore.

The potash industry also developed from the clearing of land for agriculture. However, the demand was so great that profits were sufficient to cut and burn timber that was otherwise inaccessible from a lunber standpoint.

Other industries developed from the land resource were textiles, leather-tanning and papermaking. Each had an impact on the land resource either directly or indirectly.

Leather goods and tanning were initially produced on the farm. With the development of the livestock industry the supply of leather goods became plentiful and tanneries were established. Bark for tanning was obtained from the forest resource primarily and secondarily from land clearing.

Papermaking was introduced in the colonies at Philadelphia in 1690 by Rittenhouse. This industry required considerable skilled labor and capital equipment. The paper was made from linen rags and since linen was the major fabric in this area, the city became the center of papermaking in the colonies. In later years wood pulp replaced linen in the papermaking process.

During the period of colonial industrial development the population of the colonies increased. Wars in Europe forced thousands of settlers to seek refuge in this country. With this increase a greater demand was placed upon the land for food, fiber and urban expansion.

Post Colonial Growth

The 18th century saw the relatively large-scale development of the middle colonies. From about 1720 until the Revolution, immigration greatly increased. Seeking religious freedom and rich agricultural lands, Swiss, Germans and Dutch migrated inland. Germans settled in the limestone soils of southeastern Pennsylvania. Moravians founded Bethlehem, and Mennonites established Lancaster.

During this period the volume of sea trade of the coastal cities was rapidly expanding. Expansion of trade had two related effects. First, the older port cities grew in population size. By 1750, Boston, New York, and Philadelphia had each exceeded a population of 8,000 people.

The development of agriculture both inland and along the coast added to the export and local market-place functions of the principal cities. By 1760 Philadelphia and New York had more population than Boston.

By 1770 New England, the New York City area, and southeastern Pennsylvania were already fairly densely settled. The area around what was soon to be Washington, D.C., was also well populated although its character was predominantly rural. From 1810 to 1870, industrialization, aided by an expanding transportation network and increased immigration, helped to create widespread areas of high population density, as well as to swell the growth of the established urban nuclei.

Transportation, by natural waterways, roads, canals and railroads, facilitated the growth of population and economic activity by linking the coastal cities with the expanding rural hinterland and the trans-Appalachian West. The urban Northeast was an obvious center to cater to the financial and commercial needs of the heavy industry and agriculture of the expanding West. Here were port facilities for export-import, established banks to handle financial transactions, and a large consumer market. The service functions became accentuated. Moreover, a large supply of skilled labor served to attract new industries, particularly those requiring delicate finishing work. Urbanization, feeding on the initial economic impulses of trading and manufacturing, consumed more and more rural land.

A greatly increased European demand for American agricultural products, a shortage of manpower and the domestic demand brought about by the Civil War, encouraged farmers to increase their production of grain and meat. The combined result was an agricultural revolution, marked by the change from hand power to animal power for most farming operations and an emphasis upon producing for the commercial market.

In 1862 four laws were passed that influenced land use. The Homestead and the Transcontinental Railroad Acts encouraged Western settlement. The Land Grant Act established institutions to promote education. The Act establishing the Department of Agriculture advanced the sciences of agriculture, education and research.

In 1885 New York purchased land for the establishment of a forest area. All the lands then owned or thereafter acquired by the State in fourteen counties in the Adirondack and Catskill regions constituted a "forest preserve". The preserve was administered by a commission to "maintain and protect the forests now on the forest preserve, and to promote as far as practical the further growth of forests thereon". In 1894 the inclusion of Article XIV, Section I, in the State Constitution, provided that all lands in the preserve shall forever be kept as wild land and forbade the cutting of timber, dead or alive, on state-owned lands within its boundaries.

This proviso precluded any attempt at forest management. Today these areas total around 2.6 million acres and provide many services to the people of New York.

Pennsylvania was the only other state to embark on a program of state forests prior to 1900. In 1897 it provided for the acquisition of land for state-forest reservations and extensive purchases were inaugurated shortly thereafter.

During this same time technological and economic changes were taking place in agriculture. Even though the long term expansion of agriculture continued, the percentage of American workers who were in farming declined from 53 percent in 1870 to 38 percent in 1900.

Twentieth Century Development

During the early part of the 20th century the Federal Government purchased land east of the Mississippi River under authority of the Weeks Law of 1911 and the Clarke-McNary Act of 1924 for the protection of watersheds of navigable streams and for timber production. These lands are now part of the National Forest System and are administered under the principles of multiple use and sustained yield for their basic resources: water, outdoor recreation, timber, wildlife, asthetics and forage. Within the National Forest boundaries in the NAR there are nearly 3,890,000 acres of which 2,243,000 acres are federally owned.

State forests were also created in response to depleted, idle, burned over and cut-over forest lands. Basically, state forests are lands held in trust for the people to provide for the common good. This good is reflected in the establishment of forests for the production of forest products, erosion control, water supply, recreation pursuits and hunting and fishing. The development of state forests progressed slowly in the early decade of the 20th century but all states in the Region now have state forests. The Weeks Act also stimulated the organization of state departments of forestry and the Clark-McNary Act expanded their activities. States provide planting stock to landowners, promote efficient management of forest land and provide forest fire control.

The period from the Spanish-American War to World War I was one of stability in agriculture as productivity was increasing at a rate comparable to that of the population. During World War I farmers responded to appeals to increase the production of grain and meat for our allies and the armed forces. After the war prices for agricultural goods dropped sharply but production continued to increase. Land less suited to agriculture was cultivated for crop production to offset lower farm prices. This led to the Agricultural Adjustment Act of 1936 which was aimed at adjusting production to demand. Poorer quality cropland then reverted to forest and pasture.

The abilities of the farmers to produce crops, along with the legislation of the 1930's, were severely tested during World War II and farmers responded with a great outpouring of food and fiber.

The present expanding agricultural revolution is the result of technological progress including the greater use of lime and fertilizer, the adoption of cover crops and other conservation practices, the use of improved plant varieties, more effective control of insects, plant diseases and weeds and a wider use of irrigation. Both forestry and agriculture have profited from the development and application of machinery for the production of food, fiber and forest products. Harvesting equipment for forest and specialized farm crops is one of the latest technological advances greatly reducing labor requirements.

A rapid decline in the number of farms and of total land in farms has been accompanied by an increase in production. Forests have generally increased in both acreage and volume. Much of the agricultural land was converted to urban land and the last century saw a general filling-in of the heavily populated belt from Boston to Washington. The Boston metropolitan area was linked to Connecticut via Worcester, and the suburbanization of Fairfield County filled in the gap between New Haven and New York. New York City's growth stretched northward along the Hudson, and widened southward in New Jersey. Pennsylvania's high density area extended northward to the coal fields and westward toward its rich agricultural lands. By the end of the nineteenth century the outlines of a continuous high density belt from Boston to Washington had begun to emerge.

When effective land transportation developed to replace coastal water transportation in the area during the late 19th century, the cities were linked by heavily-trafficked main line railroads, and later by express highways and by shuttle airlines, all of which carry the heaviest volumes of intercity traffic in North America. With the efficient transportation links, the urbanization spread along the axis and the adjacent tentacles coalesced, eventually merging the older nodes into a lineal city. The Boston-Washington axis constitutes the classic example of a lineal intercity corridor.(1)

The evolution of seaboard trading centers, to major commercial and industrial cities, to metropolitan areas, and finally to a dense metropolitan system of settlement has given rise to the term "megalopolis".

METHODOLOGY AND ASSUMPTIONS

Data Source

Data were assembled from existing records and reports based on comparability throughout the Region. Translation of data was from larger units or county approximation to hydrologic unit.

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(1) Numerals in parentheses refer to the bibliography at the end of the Appendix.

Land capability classes and subclasses from Conservation Needs Inventory (CNI) (2) data were assembled by use of computer program.

Costs and accomplishments of agricultural and forest programs were derived from agency accomplishment reports and field staffs.

A least-cost linear programming model was utilized to assess the size and location of agricultural production. Land, labor and capital costs are considered. Productivity of the land base by Land Resource Area (LRA), land class and subclass enters the model and is converted to land use utilizing a least-cost criteria. Along with the land base projections, regional food and fiber requirements served as constraints to the model which include a pattern of land to assess visual quality requirements. Varying assumptions are used to show sensitivity of land use shifts to changing cost situations.

The Urban Section of Appendix G draws heavily on three primary sources of information and analysis. They are Appendix B (3) Study of Present and Projected Urban Development and Land Use in NAR (4) and the Study of Visual and Cultural Environment (5).

The projections and conclusions contained in the foregoing reports have been reviewed, synthesized and recast for purposes of developing the urban input. The assumptions and methodologies that were used to project population, economic base, developed land parameters, and visual and cultural environment will be set forth in the relevant sections of this report.

Data on population and land area estimates and projections cited by the USDA do not always coincide with those developed by the Regional Plan Association (RPA). Since most of the estimates and projections are intended to show orders of magnitude rather than precise quantities, the HUD and USDA staffs agreed that the figures would be allowed to stand as they are.

Assumptions

Owing to the diversity of the report, the assumptions will be discussed in those sections of the Appendix where they are most applicable.

RELATION TO OTHER PARTS OF THE REPORT

The Land Use and Management Appendix has either direct or indirect relationships with all other appendices of the study inasmuch as the land serves as a base for all other activities and resource development.

III - REGIONAL SUMMARY OF RESOURCES

REGIONAL BASE

Climate

The NAR extends from Maine to the southern part of Virginia and thus it has a wide range of climatic conditions.

Elevations range from sea level to over 6,000 feet. The proximity of the ocean has a tempering influence on the climate of the coastal areas of states within the Region. The variation of the growing season ranges from nearly 100 to 200 days.

Three types of weather patterns influence the Region: cold dry air pouring down from subarctic North America; warm moist air from the Golf States; and cool damp air moving in from the Atlantic Ocean.

The northern portion of the Region is influenced by the easterly migration of the cyclones entering the United States in the Pacific Northwest or in the Colorado Basin. The southern portion of the Region receives its weather variations from the cyclones crossing the southern portion of the United States. Normally the southern cyclonic movements bring warm moist air from the Gulf of Mexico and provide abundant moisture.

The entire Region is classified as humid and generally receives adequate moisture for agricultural purposes. Rainfall generally is distributed uniformly during the growing season and periods of extended drought are rare.

Occasionally, major floods occur throughout the Region. The majority of the floods are caused by a combination of spring rains and melting snow, particularly in the northern portion of the Region.

While numerous tornadoes have occurred within the Region they are not a common phenomena and have resulted in limited losses. Hailstorms frequently accompany severe thunderstorms but normally do not cover large areas.

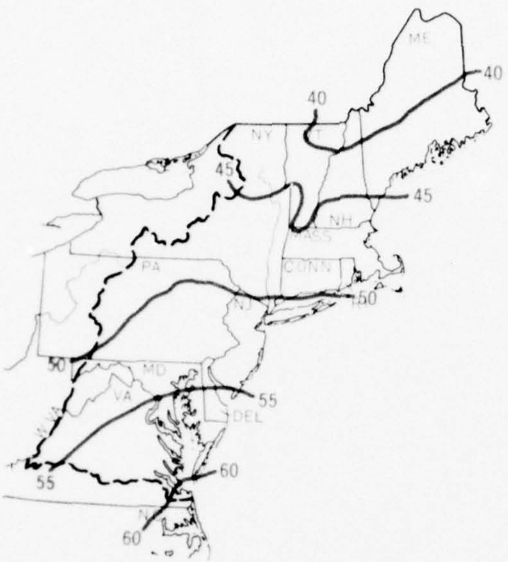
Climate is a significant factor in the Region's agriculture. The combination of reliable annual precipitation and humid climate is favorable for growth of agricultural crops and forests.

Precipitation. Figure G-2 shows the normal annual total precipitation in the Region. Table G-2 indicates relative differences in seasonal distributions for selected stations in each of the states throughout the Region.

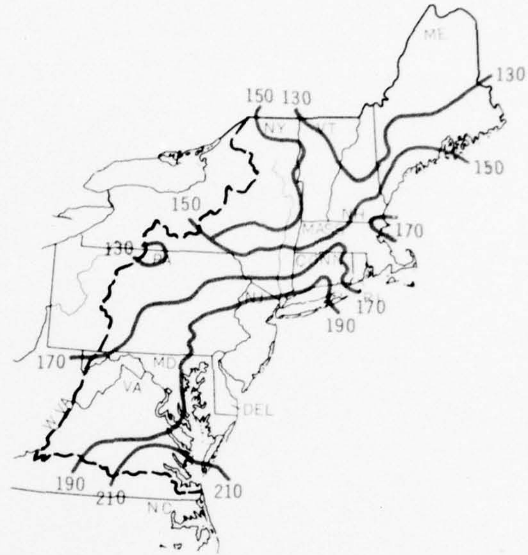
The NAR is unique in that the distribution of precipitation is relatively uniform throughout the year in all areas. While

CLIMATIC DATA

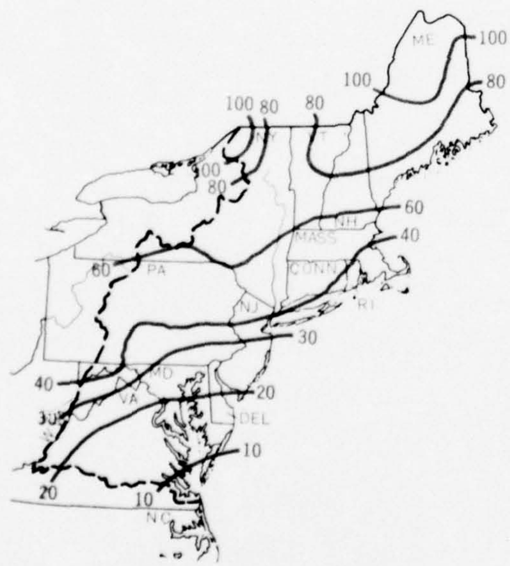
NORTH ATLANTIC
REGIONAL WATER RESOURCES STUDY



AVERAGE ANNUAL TEMPERATURE (°F)



MEAN LENGTH OF FREEZE-FREE PERIOD (DAYS) BETWEEN LAST 32°F TEMPERATURE IN SPRING AND FIRST 32°F TEMPERATURE IN AUTUMN



AVERAGE ANNUAL SNOWFALL
(INCHES)

NORMAL ANNUAL TOTAL PRECIPITATION
(INCHES)

USDA-SCS-HYATTSVILLE, MD 1970

FIGURE G-2

TABLE G-2
MEAN TEMPERATURE AND PRECIPITATION
NORTH ATLANTIC REGION

Section	January		February		March		April		May		June		July		August		September		October		November		December		Annual	
	Temperature	Precipitation	Temperature	Precipitation	Temperature	Precipitation	Temperature	Precipitation	Temperature	Precipitation	Temperature	Precipitation	Temperature	Precipitation	Temperature	Precipitation	Temperature	Precipitation	Temperature	Precipitation	Temperature	Precipitation	Temperature	Precipitation	Temperature	Precipitation
Millinocket, Maine	15.7	3.19	17.7	2.84	28.1	3.34	41.2	3.52	53.5	3.33	62.8	3.77	68.1	3.39	66.3	3.78	57.7	3.78	46.5	3.64	34.2	4.11	20.1	3.46	42.7	42.15
Concord, New Hampshire	20.1	2.91	21.2	2.30	31.8	3.04	43.0	3.08	54.8	3.04	64.1	3.62	69.0	3.57	66.5	3.10	58.8	3.39	48.0	2.80	36.7	3.57	24.0	2.81	44.8	37.23
Burlington, Vermont	17.9	1.89	18.1	1.53	29.3	2.19	42.3	2.63	55.4	2.89	65.5	3.57	70.4	3.75	68.1	3.01	59.9	3.14	48.2	2.89	36.4	2.85	22.8	1.88	44.5	32.22
Lowell, Massachusetts	26.6	3.80	27.4	3.16	36.1	4.19	47.1	3.60	58.9	3.45	67.9	4.52	73.7	3.37	71.5	3.70	63.6	3.72	53.2	3.14	41.5	4.20	29.8	3.55	49.8	43.40
Kingston, Rhode Island	29.5	4.12	29.7	3.27	36.7	4.26	45.6	3.83	55.7	3.49	64.2	3.06	70.1	2.57	68.9	4.66	62.2	3.74	52.5	3.21	42.2	4.74	31.7	3.75	49.1	44.70
Storrs, Connecticut	26.5	3.62	26.7	2.82	34.5	4.34	45.2	3.84	56.4	4.04	65.1	3.65	70.2	3.56	68.4	5.13	61.2	4.07	51.7	3.35	40.6	4.23	29.1	3.56	48.0	46.21
Salisbury, New York	18.7	3.78	18.8	3.18	28.0	3.58	41.2	3.56	53.4	4.04	62.6	4.17	67.3	5.01	65.1	4.39	57.3	4.63	46.9	4.19	34.9	3.96	21.7	3.50	43.0	47.99
Williamsport, Pennsylvania	28.5	2.59	29.1	2.34	38.3	3.34	49.1	3.54	60.2	4.31	69.2	3.42	73.3	3.71	70.9	3.61	64.6	3.33	53.0	3.37	41.7	3.26	30.9	2.67	50.7	39.49
New Brunswick, New Jersey	32.3	3.34	32.8	2.77	40.2	3.75	51.1	3.48	61.6	3.75	73.1	3.63	75.0	4.53	73.2	4.70	66.5	4.06	56.1	3.16	45.3	3.64	34.2	3.17	53.2	43.98
Dover, Delaware	36.8	3.97	36.7	2.98	44.3	4.18	53.7	3.56	64.4	4.39	72.9	3.61	77.2	4.50	75.4	5.75	69.3	3.70	58.7	3.15	47.8	3.49	37.9	3.12	56.3	46.40
College Park, Maryland	36.5	3.40	36.7	2.63	44.6	3.74	54.1	3.36	64.6	4.45	72.7	3.95	76.8	3.88	75.0	5.32	68.5	3.96	57.6	3.26	46.6	3.21	37.0	3.00	55.9	44.16
Piedmont, West Virginia	32.8	2.98	33.2	2.02	40.9	3.84	51.5	3.22	61.8	3.98	69.7	4.14	73.6	3.42	72.1	4.11	65.3	3.00	55.1	2.82	42.8	2.27	33.1	2.45	52.7	38.25
Richmond, Virginia	38.3	3.64	39.7	2.76	47.5	3.42	56.1	3.23	65.8	3.64	74.3	3.87	77.5	5.64	75.9	5.05	70.3	3.65	58.8	2.16	48.4	2.49	39.5	2.89	57.7	42.89

Source: U.S. Department of Commerce, Weather Bureau.
1/ Averages for the period 1931-1955. Selected stations were taken from the States within the North Atlantic Region

the ocean influences the precipitation of the Region to some degree, the principal year-round moisture producers occur from low pressure storm systems.

Prolonged droughts are quite rare but short dry spells, particularly in the southern part of the Region, prompt the use of supplemental irrigation for the production of crops.

Annual snowfall varies from over 100 inches in Maine and upper New York to 10 inches in Virginia. (Figure G-2).

Winds. Much of the NAR lies under the influence of the prevailing westerlies, the belt of generally eastward air movement which encircles the globe in the middle latitudes. During the colder months, the prevailing wind is northwest over the Region while from April to September southwest or south winds predominate. The topography of the Region has a strong influence on the prevail-wind direction. The prevailing winds in the valleys parallel the direction of the valleys. In the Fall, Winter and early Spring, it is not unusual to experience brief windstorms associated with gusts of 50 to 60 miles per hour.

Hurricanes or storms of tropical origin occasionally affect the Region, particularly the coastal areas. Coastal storms or "northeasters" generate very strong winds and heavy rains. In the winter they produce large snowfalls. When coastal storms occur at the time of rising tide, heavy water damage results.

Temperature. The average annual temperature varies considerably from the northern to the southern boundary in the Region. The average annual temperature is 40°F. in the north, with an average of 130 frost-free days annually to 60°F. in the south, with an average of 210 frost-free days. (Figure G-2)

Coastal areas have more moderate temperature changes than inland areas owing to the influence of the ocean. Mountainous terrain tends to have lower temperatures than Piedmont and coastal plains.

The differences in the length of the growing season are reflected in the considerable diversity of agricultural products for the Region. With a low of 117 frost-free days in the north, the types of crops grown are severely limited. The southern portion of the Region has a much greater diversity of types of crops with areas having 200 to 250 frost-free days.

Summers in the NAR are cool in the north and hot and humid in the south. Winters are cold in the north and mild in the south. Temperature extremes range from a high of over 100°F. to lows of -40°F. In general, the temperature is good for crop production throughout the Region.

Physical Features

Topography

The topography of the Region varies from mountainous terrain with elevations of over 6,000 feet to the coastal plain with elevations at sea level. The major topographical divisions in the Region are mountains, upland plateaus, lowland plains, coastal plains, and ridges and valleys. The topography of the Region is illustrated in Figure G-3.

Many of the mountainous areas in New England are nonagricultural while the Catskill, Allegheny and Taconic Mountains have valleys and slopes that are cultivated as small farms.

The upland plateau includes most of the inland, nonmountainous area of New England and the northern Piedmont areas.

The lowland plains are along the seaboard in New England and the Mohawk River Valley in New York.

The coastal plains extend from Long Island through Virginia and vary from a narrow strip to nearly 200 miles in width. Elevations range from sea level along the tidal streams and bays to a little more than 300 feet in southern Maryland.

The ridge and valley divisions are small and are made up of a series of parallel ridges separated by narrow, fertile valleys. The area runs from south central Pennsylvania northeastward and includes the Hudson River valley in New York.

Physiography

Pleistocene ice sheets covered the NAR as far south as northern New Jersey and Pennsylvania. The general effect of the glaciation was to scrape clay, sand, gravel and boulders from hills and mountains and to deposit it principally in valleys. Drainage was changed and lakes, swamps, falls and gorges were formed.

Within the NAR there are 16 major physiographic divisions, five are in the Central Appalachian System and 11 are in the New England Appalachian System. The divisions are illustrated in Figure G-4.

Plateau Province. The Plateau Province represents the interior stable region of the continent where very gently folded strata of Paleozoic Age are dissected by an elaborate arborescent drainage system.

Ridge and Valley Province. This is the folded and thrust-faulted province of parallel or subparallel ridges and valleys. The topography has been carved from anticlines, synclines, and

thrust sheets of strata of Paleozoic Age. The rectangular drainage system of this province contrasts sharply with the arborescent drainage system of the Plateau Province.

Blue Ridge Province. Cambrian and pre-Cambrian metamorphic and igneous rocks make up the Blue Ridge Province. The rocks are highly folded and thrust-faulted toward the Ridge and Valley Province.

Piedmont Province. The Piedmont Province is an area of generally low relief underlain by chiefly metamorphosed pre-Cambrian and Paleozoic sediments and volcanics. The rocks are highly folded and faulted.

Triassic Lowland. Several of these elongated basins of Upper Triassic sandstones, shales, and diabase dikes and sills are found in the Piedmont Province. The Triassic rocks are gently tilted and extensively faulted.

Coastal Plain Province. Cretaceous and Tertiary sediments of the Coastal Plain overlap the Piedmont crystallines. The sediments thicken to the southeast and crop out in bands with the oldest sediments exposed along the fall zone, a line marked by the points to which the tide extends up the estuaries.

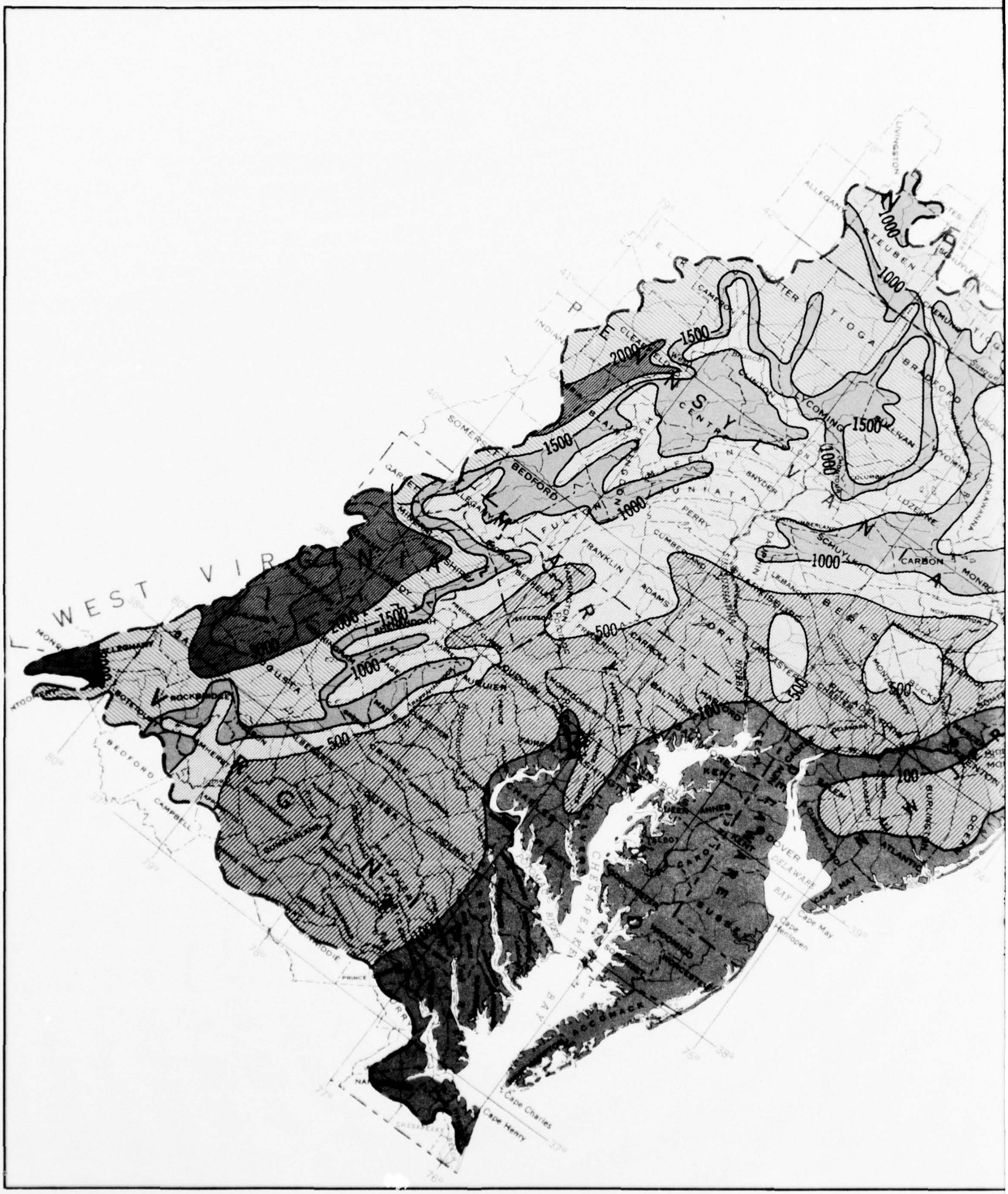
Hudson Valley. The Hudson Valley is topographically, geologically, structurally and historically a part of the Ridge and Valley Province. The Hudson Valley is narrow and the topography subdued south of the northern limit of the Catskill Mountains.

Lake Champlain Lowland. The Champlain Lowland is underlain by Paleozoic limestone, dolomite, marble, shale and slate with a few beds of quartzite. With the exception of the quartzite, the rocks are easily eroded and the surface is well worn down toward sea level. The bottom of Lake Champlain is below sea level.

St. Lawrence Valley. The St. Lawrence Valley is a smooth glacial plain underlain by slightly tilted and beveled Cambrian sandstone and Ordovician limestones and shales. Relief rarely exceeds 100 feet and occurs within the glacial drift.

Adirondack Mountains. A nearly circular uplift, the Adirondack Mountains are divided into a northwestern rolling upland of gentle relief and a southeastern rugged mountain mass with more than 40 peaks above 4,000 feet. The Adirondacks consist mainly of pre-Cambrian rocks surrounded by gently upturned Cambro-Ordovician sediments.

Mohawk Valley. The Mohawk Valley is a lowland separating the Plateau Province and the Adirondack Mountains and joining the Hudson Valley with the interior lowland. Underlain by Ordovician shales and limestones, the valley is low and smooth only in relation to the higher and more rugged provinces to the north and south.


WEST VIRGINIA
PENNSYLVANIA
1000
1500
2000
500
100
TIOGA
BRADFORD
LYCOMING
CLINTON
CENTRE
SNYDER
JUNIATA
PERRY
CUMBERLAND
FRANKLIN
ADAMS
YORK
LANCASTER
BERKS
SCHUYLKILL
LUZERNE
CARBON
BEDFORD
FULTON
SOMERSET
GARRETT
ALLEGANY
STEUBEN
CARROLL
BALTIMORE
DOVER
DELAWARE BAY
CHESAPEAKE BAY
Cape May
Cape Henlopen
Cape Charles
Cape Henry
ROCKBRIDGE
AUGUSTA
BEDFORD
CAMPBELL
ATLANTIC
BURLINGTON
KENT
SUSSEX
ACCOMACK
POTOMAC RIVER

TOPOGRAPHY

NORTH ATLANTIC
REGIONAL WATER RESOURCES STUDY

U. S. DEPARTMENT OF AGRICULTURE

October 1968

25 0 25 50 75 100 Miles

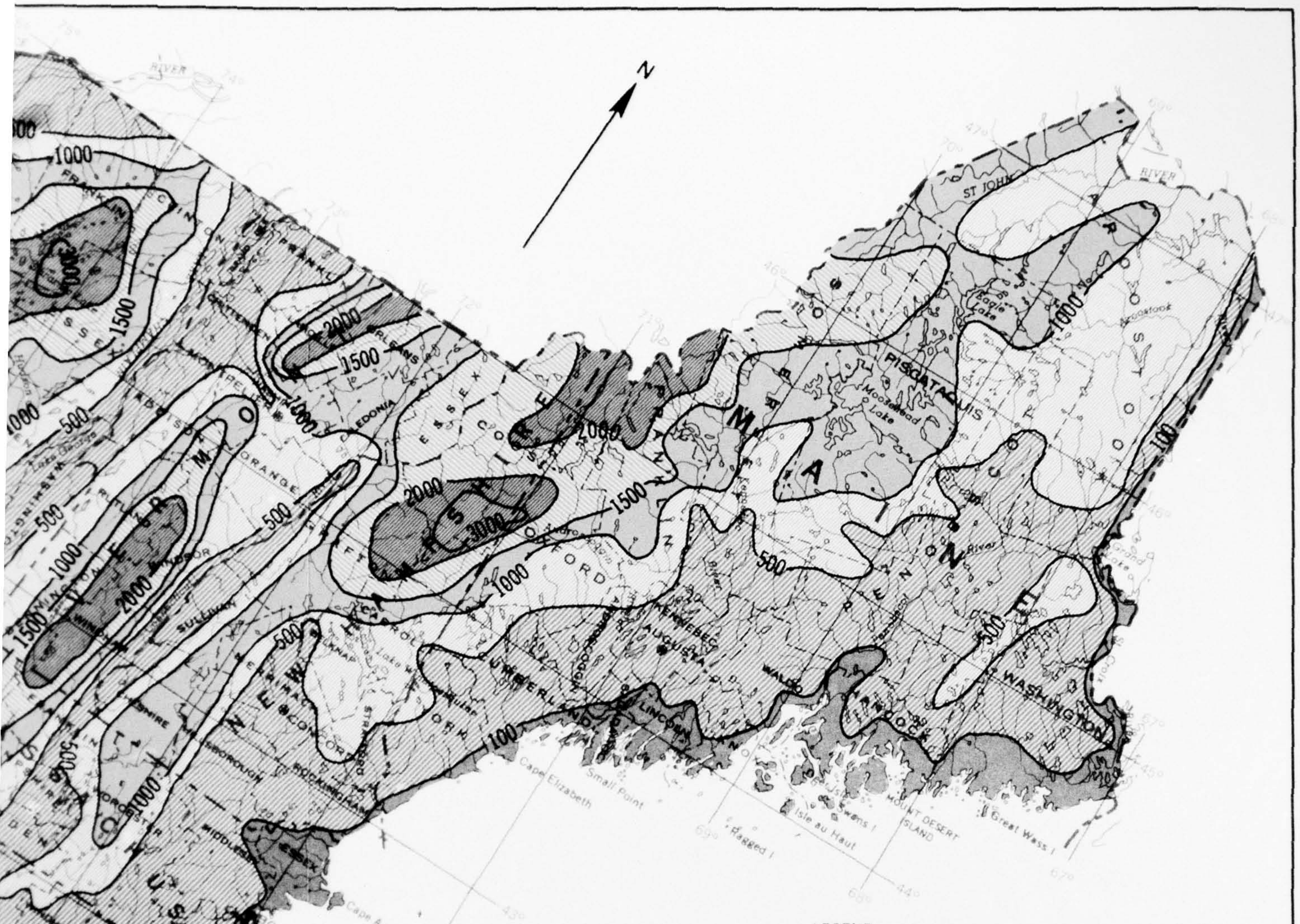


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FIGURE G-3

USDA-SCS-HYATTSVILLE, MD. 1971

Catskill Mountains. The Catskill Mountains are underlain by and owe their form to a nearly horizontal hard but deeply carved protective plate of coarse, porous sandstone or conglomerate. The highest summits are about 5,000 feet above sea level and local relief exceeds 3,000 feet.

Taconic Mountains. The Taconic Mountains are a low range of hills composed mostly of metamorphosed fine-grained sedimentary rocks of Cambrian and Ordovician Age. The mountains and valleys have a dominant north-south trend resulting from east-west compression.

Green Mountains. The Green Mountains are lower in elevation than the Adirondacks which lie across the Champlain Valley. Maximum heights are above 4,000 feet but most peaks are not much above 3,000 feet. The southern part of the Green Mountains is made up of pre-Cambrian granites and gneisses. The northern part is composed of gneiss, schist, and along the eastern flank, of ultrabasic intrusives and volcanics.

New England Upland. The New England Upland contains both wide lowlands and belts of low mountains but the area is essentially a plateau-like expanse with youthful stream dissection and pronounced monadnocks. Sedimentary, metamorphic and igneous rocks mark a long and active tectonic history of the New England Upland.

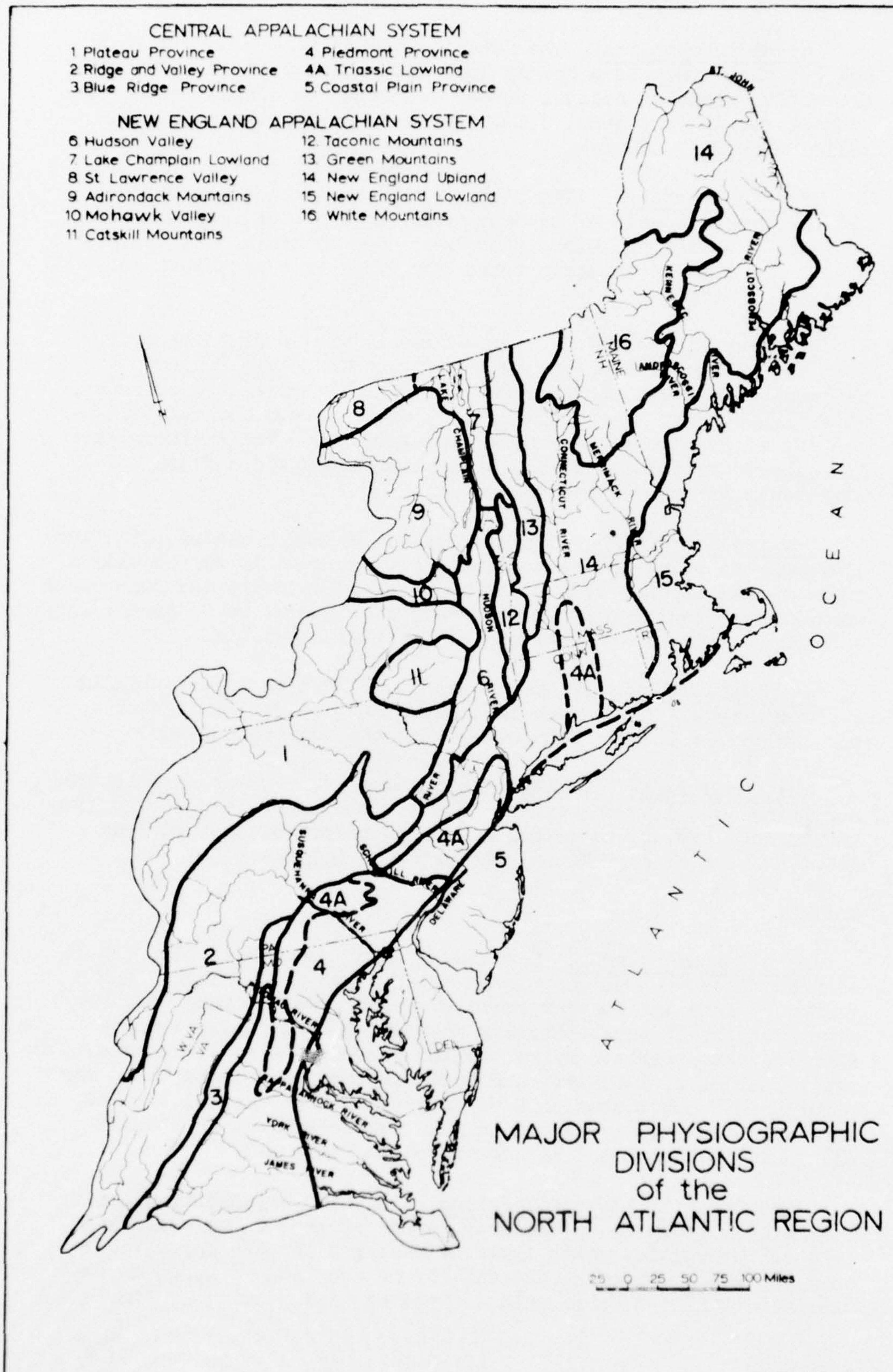
New England Lowland. The New England Lowland is essentially a sloping margin of the New England Upland, differing in that the lowland is lower and smoother than the adjacent upland.

White Mountains. The White Mountains are a group of scattered mountains formed by the action of water and ice on a great granitic intrusion. Elevations of hills and mountains vary upward from 1,500 feet to that of Mount Washington, 6,288 feet,

Soils

Land Resource Areas. The land area of the NAR is situated in six Land Resource Regions within which there are 10 major land resource areas and smaller parts of seven others. Land Resource Areas consist of geographically associated land resource units that are characterized by particular patterns of soil, climate, water resources, land use, and types of farming. These units may occur as one continuous unit or as several separate units. The Land Resource Regions and major Land Resource Areas in the NAR are shown in Figure G-5 and described in Table G-3.

Land Capability Classification. The Land Capability Classification is a grouping of different kinds of land units according to those properties which limit or restrict the use for agriculture, or which determine the ability of the land to produce permanently without deterioration. Type of soil, degree of slope

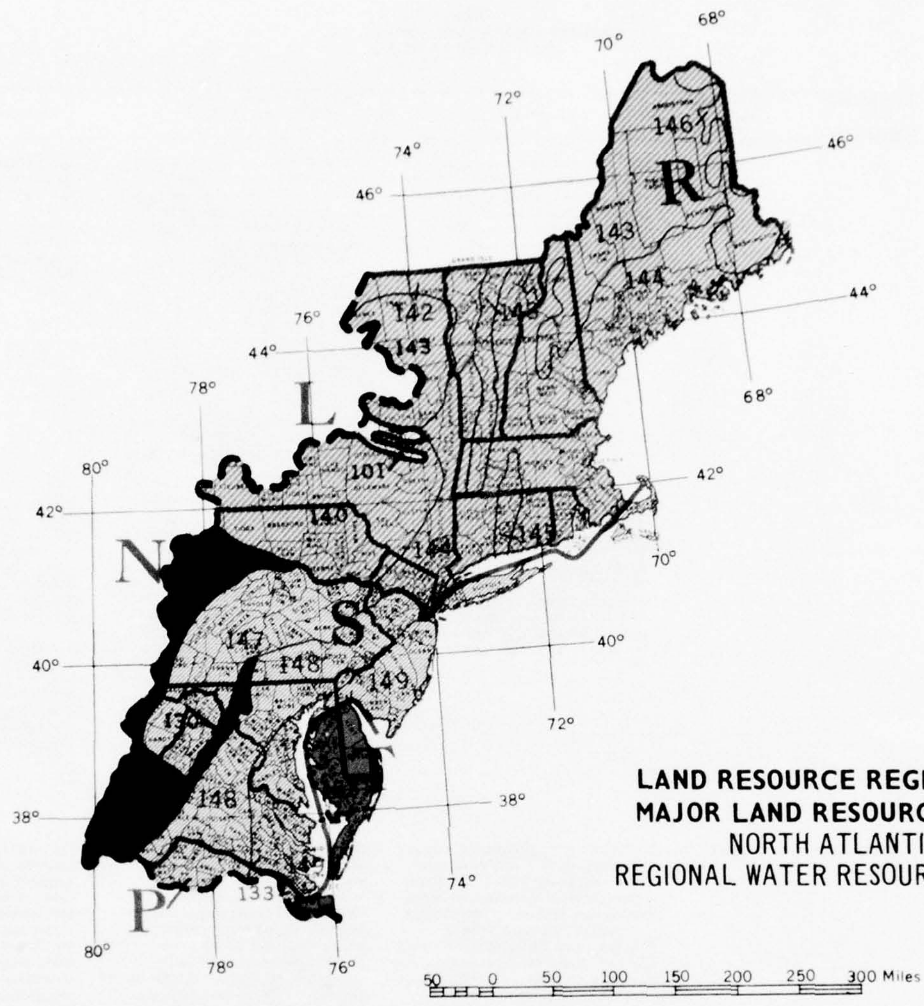


MAJOR PHYSIOGRAPHIC DIVISIONS of the NORTH ATLANTIC REGION

FIGURE G-4

USDA-SCS-HYATTSVILLE, MD. 1970

U. S. DEPARTMENT OF AGRICULTURE



LAND RESOURCE REGIONS AND MAJOR LAND RESOURCE AREAS
NORTH ATLANTIC
REGIONAL WATER RESOURCES STUDY

50 0 50 100 150 200 250 300 Miles

L LAKE STATES FRUIT, TRUCK, AND DAIRY REGION
- 101 Ontario - Mohawk Plain

EAST AND CENTRAL GENERAL FARMING AND FOREST REGION
- 127 Eastern Allegheny Plateau and Mountains
- 128 Southern Appalachian Ridges and Valleys
- 130 Blue Ridge

P SOUTH ATLANTIC AND GULF SLOPE CASH CROP, FOREST, AND LIVESTOCK REGION
- 133 Southern Coastal Plain
- 136 Southern Piedmont

R NORTHEASTERN FORAGE AND FOREST REGION
- 140 Glaciated Allegheny Plateau and Catskill Mountains
- 142 St. Lawrence - Champlain Plain
- 143 Northeastern Mountains
- 144 New England and Eastern New York Upland
- 145 Connecticut Valley
- 146 Aroostook Area

S NORTHERN ATLANTIC SLOPE TRUCK, FRUIT, AND POULTRY REGION
- 147 Northern Appalachian Ridges and Valleys
- 148 Northern Piedmont
- 149 Northern Coastal Plain

T ATLANTIC AND GULF COAST LOWLAND FOREST AND TRUCK CROP REGION
- 153 Atlantic Coast Flatwoods

October 1968

Figure G–5

USDA-SCS-HYATTSVILLE, MD. 1969

TABLE G-3
CHARACTERISTICS OF LAND RESOURCE AREAS
NORTH ATLANTIC REGION

Land Resource Area	Approximate Area 1,000 Acres	Av. Annual Rainfall Inches	Topography	Predominant Soils	Land Use and Major Crops
101 Ontario-Mohawk Plain	200	35-45	Most of the area is a nearly level rolling glacial drift plain. Drumlins (long narrow steep-sided oval hills) are prominent in the area. Low beach ridges are common. Local relief is mainly a few feet to tens of feet, but the larger drumlins rise 100 to 200 feet or more above the adjacent lowlands.	The soils are dominantly deep, medium textured, and have a moderately intricate drainage pattern which ranges from well drained to poorly drained. The drainage sequence Honeoye-Lima-Kendaia-Lyons represents these characteristics. These soils, as well as Poland and Mohawk are developed on highly calcareous glacial till. Other soils like the somewhat poorly drained Camroden and poorly drained Marcy are also developed in till. Limiting soil factors are wetness of some soils, and erosion for production of farm crops.	Approximately 80% of the area is in farms; 40% in cropland; and 20% in pasture. The principal crops include feed and forage crops for dairy cattle, winter wheat, fruits, canning and truck crops. Forest comprises 20% of the remaining area, mostly in farm woodlots.
127 Eastern Allegheny Plateau and Mountains	5,362	40-60	Elevations vary from 1,000 feet in the lowland valleys to 2,000 to 2,500 feet over much of the plateau top. The mountains rise to elevations of 3,500 to 4,500 feet in the southeast. Steep slopes are dominant but level to gently rolling plateau remnants are numerous in the north.	The soils are deep or moderately deep, medium textured, and range from well drained to poorly drained. They are developed in materials derived from the underlying sandstone and shale. The well drained soils include Gilpin, Clymer, and stony Dekalb. Important moderately well drained soils are the Cookport on ridge tops, and Ernest soils on footslopes, both with fragipans. Important limiting factors are relatively shallow depth to bedrock, and stoniness. Other factors are wetness, slow permeability, and presence of fragipans.	Farms comprise approximately 85% of the area. About 75% of the land is in forest, mainly in small privately owned holdings. National forests and large holdings make up about one-tenth of the area. Lumbering is an important industry. Minerals include gas, oil, and coal mining. Cropland and pasture comprise a small portion of the area. Hay and other feed for dairy cattle are the major crops.
128 Southern Appalachian Ridges and Valleys	4,130	35-55	The area is comprised of valleys underlain with limestones and shale and steep ridges or mountains underlain mainly by sandstones and shales. The valleys are undulating to strongly rolling or hilly with local relief of a few tens to a few hundreds of feet. Elevations range from 600 feet in the valleys to 3,000 to 4,000 feet or more.	Soils on the ridges and mountains are mostly shallow or moderately deep, medium or coarse textured, and well drained. Dekalb soils, underlain by sandstone, are moderately deep and stony. The shallow Weikert soils are underlain by shale. Soils on the lower footslopes and in narrow valleys are mostly deep and well drained. The major valleys are underlain by limestone and shale. Important soils in the valleys are the deep, fine textured, and well drained Frederick, and Hagerstown on limestone. There are also the extensive, moderately deep Berks soils developed from shale as well as some soils that are shallow to the underlying limestone. Limiting factors are shallow depth to bedrock, and stoniness on the ridges and mountains; erosion hazard for crop production in the valleys.	Seventy-five percent of the land in the area is in farms. Approximately 12 to 13 percent of the land is owned by the Federal Government. About one-half of the area is in forest, mainly small to medium-sized farm woodlots. Federally owned land is mostly in National parks and National forests. About one-sixth of the area is in cropland and an equal amount is in pasture. Feed and forage crops for livestock are the principal crops grown. Vegetables and fruits are grown for home consumption throughout the area.
130 Blue Ridge	1,075	40-50	Elevations in the lower valleys are near 1,000 feet and rise to more than 4,000 feet in the mountains. The rugged mountains have steep slopes and sharp crests and are dissected by steep narrow valleys. Local relief is in several hundreds to a few thousand feet.	Soils are medium textured, well drained, and range in depth from shallow to deep. Most of the soils are stony. Some steep mountain slopes are classed as stony land. The soils are developed from acid metamorphosed rock material. The most extensive soils are the moderately deep Porters, the deep Hayesville and Watauga, and the shallow Talladega. Limiting factors are stoniness, and shallow depth to bedrock.	Nearly 70% of the area is in forest, much of it privately owned. About 20% of the area is in National parks and forests. The balance of the area is comprised of cropland and pasture. Corn and hay are the most extensive crops. Garden crops and fruits are grown. Most of the farms are part-time enterprises and the occupants earn a large part of their livelihood elsewhere.

TABLE G-3
CHARACTERISTICS OF LAND RESOURCE AREAS
NORTH ATLANTIC REGION

Land Resource Area	Approximate Area 1,000 Acres	Av. Annual Rainfall Inches	Topography	Predominant Soils	Land Use and Major Crops
133 Southern Coastal Plain	622	40-60	The lower coastal plain elevation is about 100 feet and rises to 600 feet in the Piedmont. The area has narrow stream valleys in the upper regions with broad valleys with wide meandering stream channels in the lower parts. Local relief is mainly in a few tens of feet, but some of the more deeply dissected parts have relief of 100 to 200 feet.	Soils are deep, medium textured, and drainage ranges from well drained to poorly drained. These soils developed in unconsolidated marine sediments. Important soils are Norfolk, and Goldsboro developed from sandy material, and Craven, Lenoir, and Bladen developed from medium and fine textured materials. Wetness is the major limiting factor.	Farmland occupies nearly all of the area. A small percentage of the land is owned by the Federal Government. Over one-half of the land is in forest, nearly all in small holdings but some in larger tracts. Lumber and pulpwood are the major forest products. Nearly one-third of the area is in cropland. Cash crops include cotton, peanuts, tobacco, melons and vegetables. Less than ten percent of the land is in pasture.
136 Southern Piedmont	1,989	45-55	The topography is gently rolling to hilly with elevations from 300 to 1,000 feet. The area is a dissected plateau underlain with schists, gneisses and granites and by some basic crystalline rocks, sandstones and slates. Local relief is mainly from tens of feet to several hundred feet.	Soils are deep, medium or fine textured, and well drained. The most extensive soils, developed from granite, gneiss, and schist, are Cecil, Appling, Durham, and Louisburg. Less extensive soils, developed from basic rocks are Davidson, Mecklenburg and Iredell. Soil erosion is a major limiting factor.	Land in farms occupy the majority of the area. Nearly 60% of the land is in forest, mostly in farm woodlots. There are areas in National forests and other large holdings. Approximately 20% of the area is in cropland with tobacco as the main cash crop. Corn, grain, sorghums, small grains, and hay are other important crops. Less than one-tenth of the area is in pasture. Pulpwood is the major forest product, but hardwood and pine lumber are also important.
140 Glaciated Allegheny Plateau and Catskill Mountains	14,489	30-40	Elevations vary from 500 feet on the valley floors to 1,700 to 2,000 feet on the plateau tops and parts of the Catskills to 3,500 feet or more. The plateau tops are broad and nearly level to moderately sloping. The valleys are narrow and have steep walls and smooth floors. The Catskills have steep slopes.	Ridge tops and side slopes are dominated by deep, somewhat stony, medium textured, moderately well to somewhat poorly drained acid soils with fragipans. These are the Mardin, Volusia, Culvers, and Morris soils. These, as well as the well drained, moderately deep to bedrock Lordstown and Oquaga soils developed in acid sandstone and shale glacial till. Important soils developed in glacio-fluvial materials in the valleys are deep, medium to moderately coarse textured, and well drained; examples are Chenango and Tunkhannock. Major limiting factors are wetness and slow permeability on the ridge tops and side slopes.	Most of the area is in farms but a large acreage is in cutover forests of mixed hardwoods. The Catskills are used mainly for recreation. The principal crops are hay, pasture and some grain for dairy cattle. Potatoes are grown on the plateau top. Fruits and truck crops are produced in the narrow valleys.
141 Tughill Plateau	162	35-40	The topography of the area varies from level to gently sloping sandstone plateaus with hilly to steep margins. The elevations range from 1,000 to 2,000 feet at the plateau top; local relief is mainly a few feet to a few tens of feet, but the bordering lowlands are several hundred feet below the plateau top.	Soils are dominantly deep, medium textured, mostly poorly drained, and stony. Most soils have fragipans. They are derived from acid sandstone and shale glacial till. The poorly drained Dannemora soils are extensive on nearly level areas. Other important soils are the well drained Worth, the moderately well drained Empeyville and the very poorly drained Tughill. Important limiting factors are wetness, slow permeability and stoniness.	Forest comprises the major portion of the land use in the area. 90% of the land is in private ownership with the remainder Federally owned, or urban, or in other uses. Part of the forest land is abandoned cropland that has been reforested. Principal forest products are pulpwood, lumber and maple syrup. Less than 20 percent of the area is in cropland and pasture. Major crops are forage and feed grains for dairy cattle.
142 St. Lawrence-Champlain Plain	2,120	35	A smooth lacustrine and glacial plain comprises most of the area. Elevations start at 100 feet and increase to 1,300 feet from Lake Champlain to both the east and the west. Local relief is in only a few feet but some outwash terraces rise sharply several tens of feet above the adjacent plains.	Important soils in this area are the poorly drained, fine textured Panton and Livingston developed in calcareous lacustrine sediments, and the moderately coarse textured drainage sequence, from well drained to poorly drained, Worth-Empeyville-Westbury-Tughill soils with fragipans developed in acid till. The moderately well drained Woodbridge and poorly drained Cabot developed in till also have fragipans. The area also includes some well drained and moderately well drained nonacid soils like Nellis and Amenia developed on calcareous till, as well as some sandy and gravelly soils like Windsor, Melrose and Colton. Limiting soil characteristics are wetness, stoniness in some of the till soils, and extensive rock outcrops in parts of the area.	Ninety-five percent of the area is in farms with five percent of the land for urban and other uses. Cropland and pasture are predominant and occupy nearly 70% of the area. Grain, hay and silage are grown for dairy cattle. Potatoes are grown for a cash crop and a few apple orchards are found on the slopes along Lake Champlain. Approximately one-fourth of the area is in forest. Lumber is the main forest product and cedar oil, Christmas trees and maple syrup are produced on some farms.

TABLE G-3
CHARACTERISTICS OF LAND RESOURCE AREAS
NORTH ATLANTIC REGION

Land Resource Area	Approximate Area 1,000 Acres	Av. Annual Rainfall Inches	Topography	Predominant Soils	Land Use and Major Crops
143 Northeastern Mountains	23,056	35-50	The elevations of the valley floor are approximately 100 feet and rise to peaks of 5,000 feet. The mountains are underlain by granite, anorthosite, schists, and slate and are thinly mantled by glacial till. The broadened valleys are deeply filled with outwash and contain many swamps and lakes.	This area includes extensive acreages of both shallow and deep soils. Textures range from coarse to medium. Soils in the Adirondacks, Green Mountains, and White Mountains are developed on granitic till, and are mainly very stony, and well drained. Most of the soils are moderately deep or deep, but shallow soils and rock outcrops are common. Important series are Hermon, Becket, and Canaan, and in the Green Mountains, Berkshire and Marlow. Hermon and related soils also occur in Maine, but here most of the soils are developed on till from shale, slate and schist. Drainage ranges from well to very poor. Important series are Thorndike, Plaisted and Monarda. Peat bogs are common. Stoniness, shallow depth and wetness are limiting factors.	Forests comprise more than 90% of the area. Most of the Adirondacks are in a State park. There are a few large areas in New England in National and State forests, but much of the area is privately owned. Forest products include lumber, Christmas trees and maple syrup. The area is widely used for recreation and there are many summer and winter sports. Cropland and pasture occupy less than five percent of the area. Farming is a part-time enterprise, and most farm operators earn a major part of their living at other occupations.
144 New England and Eastern New York Upland	17,581	35-45	The elevation of the coastal lowland begins at sea level and rises throughout the area to hills of 2,000 feet and a few isolated peaks of 3,000 feet. Rolling and hilly uplands are broken by many gently sloping valleys that terminate in coastal lowlands. Relief is mostly in a few feet to a few tens of feet in the valley and rises to a few hundred feet in the uplands.	In the Hudson River Valley, soils developed from glacial till are dominant. They are dominantly deep and medium textured. Examples are the moderately well drained Troy with fragipans, and the well drained Cossayuna soils. The shaly shallow to bedrock Nassau soils are fairly extensive. Other important soils are the excessively drained, deep, fine sandy Colonie developed in deltaic deposits. East of the Hudson River Valley the most extensive soils are developed in acid glacial till. They are mostly stony, deep, and moderately coarse textured. The drainage pattern is intricate and the range is from well drained to very poorly drained. Important soils are Hermon, Becket, Bangor, Gloucester, Charlton, Ridgebury, and Whitman. Hollis and Shapleigh soils are shallow to bedrock. Important soils developed in glaciofluvial materials along the major streams are deep, well or excessively drained with gravelly sandy loam horizons underlain by sand and gravel. Examples are Merrimac and Hinckley. Soil factors which cause limitations include fragipans or firm underlying glacial till which reduce permeability, shallow depth to bedrock, sandy textures in some soils, and east of the Hudson River Valley presence of many stones on the surface and in the soils.	Forest covers over 60% of the area with the most of the forest in small holdings in farm woodlots, but with some State forests or other large holdings. Forest products include lumber, maple syrup, and Christmas trees. Nearly 20% of the area is in cropland and pasture. Forage crops for dairy cattle, potatoes, vegetables and apples are grown on the farms. Much of the farming is on a part-time basis. About 10% of the area is in urban and the amount is increasing rapidly especially in the south.
145 Connecticut Valley	1,860	45"	Elevations vary from sea level to 300 feet in the lowland rising to ridge crests of 500 to 1,000 feet. The nearly level to sloping lowlands are broken by isolated traprock ridges that have hilly and steep slopes. Local relief has a range of a few feet in the lowlands to several hundred feet on the ridges.	Soils in this area are dominantly deep, well drained, and range from medium to coarse textured. Important soils on the Connecticut River terraces and adjoining gentle slopes are the Enfield, and Narragansett which developed in a 20 to 30 inch thick mantle of silty material over sand, gravel, or loamy glacial till; also the deep, excessively drained sandy Windsor and Merrimac, the latter underlain by gravel and coarse sand. Cheshire and Wethersfield soils are extensive on the sloping glacial till uplands. Soil erosion, including wind erosion, are limiting factors for farming. Lack of good internal drainage and slow permeability are limitations in local areas. Wethersfield soils are stony.	Nearly 80% of the area is in farms with most of the remainder in urban or in built-up areas. Cropland and pasture comprise nearly one-fourth of the land in farms. Principal crops are tobacco, vegetables, potatoes, fruits, nursery stock and forage crops for livestock. About one-half of the area is in forest mainly in farm woodlots. Forest products include fence posts, firewood, lumber, maple syrup and Christmas trees.

TABLE G-3
CHARACTERISTICS OF LAND RESOURCE AREAS
NORTH ATLANTIC REGION

Land Resource Area	Approximate Area 1,000 Acres	Av. Annual Rainfall Inches	Topography	Predominant Soils	Land Use and Major Crops
146 Aroostook Area	4,389	36-40	This area is a nearly level to rolling glaciated plain cut by narrow valleys. Elevations range from 300 to 500 feet with a few hills at 1,000 feet. The uplands are covered with thin to thick till and the valleys are deeply filled with outwash and alluvium. Local relief is in a few feet to a few tens of feet.	The most extensive soils in this area are deep, well drained, and medium textured. Less extensive soils include some that are shallow to bedrock, and some that are moderately well drained or poorly drained. The dominant soils in the potato growing portion of the area, developed on weakly calcareous till, are Caribou, Mapleton, and Conant. Dominant soils in the wooded area are the more acid Plaisted, Howland and Thorndike. Soil erosion is a limiting factor in the production of potatoes and other farm crops. Shallowness, stoniness and wetness are limiting factors on some soils.	The land in the area is nearly all in farms and over one-half is cleared and used for cropland. Potatoes are the major crop, but some land is in oats and hay meadow in support of dairying. The remaining land is in forest, mostly farm woodlots. The main forest products are lumber, maple syrup and Christmas trees.
147 Northern Appalachian Ridges and Valleys	9,317	32-45	The topography of this area varies from undulating to rolling valleys with elevations of 100 feet to 1,200 to 2,500 feet on ridges and mountains with some mountain crests at 3,000 feet elevations. The limestone and shale valleys are narrow to moderately broad. The ridges have hilly to steep slopes and narrow rolling crests. Local relief in the valleys is in several tens of feet to 100 to 200 feet. Ridges rise several hundred feet above adjoining valleys.	This is an area of ridges and valleys. Soils on the ridges range from shallow to deep, and are mostly well drained, and medium textured. Dekalb, underlain by sandstone, and Calvin and Berks underlain by shale are moderately deep. The Weikert soils are shallow. Soils in the valleys are mostly deep, well drained, medium or fine textured. Hagerstown and Duffield are underlain by limestone. The well drained Murrill and Laidig, and the moderately well drained Buchanan are representative of soils developed in thick colluvium on footslopes. Limiting factors on the ridges and side slopes are stoniness and bedrock at relatively shallow depth. Erosion for production of cultivated crops is a limiting factor in the valleys.	Nearly 85% of the area is in farms and the balance is in urban and other uses; 30% of the area is in cropland. The principal crops are tobacco, forage and feed grains for dairy cattle, apple orchards and truck and canning crops. Poultry farming is important throughout the area. Permanent pasture occupies less than 10% of the area. Forest comprises nearly one-half of the land, mainly in small to medium size holdings and some in State and National forests.
148 Northern Piedmont	10,224	40-45	The dissected plain or plateau is underlain by gneisses, schists and related rocks, and is broken by narrow ridges. The elevations are generally 300 to 1,000 feet with some ridges and isolated peaks rising to 1,500 feet or more. The topography is gently to strongly rolling with local relief in a few tens of feet to 100 or more feet.	The most extensive soils in this area are deep, well drained and medium textured. They developed in four major kinds of materials. Chester, Glenelg, Elioak, Manor, and Glenville developed in material from gneiss and schist; Montalto and Neshaminy from traprock; Duffield and Hagerstown from limestone, and Penn, Bucks, Readington, and Croton from Triassic sandstone and shale. All of these are well drained except Glenville, Readington and Croton which range from moderately well to poorly drained.	Over 80% of the land area is in farms. Urban areas and other uses comprise approximately 20% of the area. About one-third of the entire area is cropland. The proportion of cropland is greater in the northern part of the region. The crops grown include forage crops and grain for dairy cattle, tobacco, canning and truck crops, orchards, and some poultry farms. Pasture occupies nearly one-eighth of the area and one-third is in forest, mainly farm woodlots.

TABLE G-3
CHARACTERISTICS OF LAND RESOURCE AREAS
NORTH ATLANTIC REGION

Land Resource Area	Approximate Area 1,000 Acres	Av. Annual Rainfall Inches	Topography	Predominant Soils	Land Use and Major Crops
148 (Cont'd.) Northern Piedmont				Soil erosion is a limiting factor for farming on these soils except on nearly level areas. Less extensive soils have some other limitations including restricted drainage and restricted permeability, and shallow depth to bedrock.	
149 Northern Coastal Plains	7,204	35-50	The undulating to rolling dissected coastal plain is underlain by unconsolidated sands, silts and clays. Elevations vary from sea level to 300 feet but less than 200 feet in most of the area.	Soils are deep, and textures range from coarse to fine. Drainage ranges from excessive to poor, and over most of the area, drainage patterns are complex. The soils developed in unconsolidated marine sediments. Soils with medium textures and a drainage range from well to poor are illustrated by the Sassafras-Woodstown-Fallsington-Pocomoke sequence. Collington and Adelphia soils, containing gr ensand are medium textured, well and moderately well sandy, excessively drained Lakewood, Evesboro and Galestown soils are extensive; so are the silty Matapekke and Mattapex, the clayey, moderately well drained Keyport and the poorly drained Elkton soils. Limitations are erosion hazard on sloping soils, and wetness.	Land in farms comprises nearly 75% of the area. Urban and other uses make up the remainder of the area. The amount of urban land is increasing rapidly. Intensive recreation and resort areas are located along the coast. About 60% of the land is in forest, mainly in farm woodlots, but partly in large holdings. Forest products include lumber and pulpwood. Approximately 20% of the land is in crops with less than 5% in pasture. Major crops are fruits, vegetables, tobacco, corn, soybeans, small grains and forage crops for dairy cattle. There is also some poultry farming in the area.
153 Atlantic Coast Flatwoods	4,000	40-50	The nearly level coastal plain is crossed by many broad shallow valleys with widely meandering stream channels. The elevations are sea level to 100 feet on low escarpments from the coast inland. Local relief is mainly a few feet to ten or twenty feet. Some short steep slopes border the stream valleys.	Soils are deep with textures ranging from coarse to fine. They are developed in unconsolidated marine sediments. Moderately well, poorly and very poorly drained soils predominate, but there are also some that are well drained. Extensive areas of moderately well, poorly and very poorly drained soils are represented by Woodstown, Fallsington and Pocomoke with sandy loam textures. Rutlege with sandy textures, and Keyport, Elkton and Bayboro with clayey textures. Other soils developed in 2 to 4 foot thick silty material overlying sandy material are the Matapeake, Mattapex, Othello and Portsmouth soils in order from well drained to poorly drained. Drainage is the important limitation in this area.	The major portion of the area is in farms, but there are some national forests, game refuges and related uses. Two-thirds of the area is in forest partly in farm woodlots, but much in large holdings. Forest products include pulpwood, lumber and naval stores. About one-eighth of the area is cropland and only one to two percent is in pasture. Major crops grown are vegetable crops, fruits, melons, sweet potatoes and Irish potatoes, with some corn, soybeans, wheat and barley. There is also some poultry farming.

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and extent of erosion comprise a land unit. The units used for land classification are characterized by differences which significantly affect conservation practices, use suitability, crop yield and management requirements.

There are eight land capability classifications. The range of the classes is from no or few limitations in use to land with severe limitations in use. Soils in Class I through IV are suitable for cultivation and other uses while soils in Class V through VIII are generally unsuitable for cultivation. They are used for pasture, forest, wildlife habitat, recreation, water supply and aesthetic purposes. Land that has not been classified is identified by an asterisk in the tables. See Table G-4, sheets 1 through 6, for Land Capability Class Distribution by Areas. The distribution of land use in percent by land capability is shown on Table G-5. The major portion of unclassified land falls in the Urban and Other land uses as illustrated in Table G-6 Land Capability by land use.

The classification of all land is based on information obtained from soil surveys. The regional distribution of land by capability classes is shown on Table G-7.

Land capability classes are broken into subclasses to indicate major limitations or hazards within the classes. There can be as many as three subclasses within most capability classes to indicate erosion hazards, wetness, or root zone limitations.

Subclass "e" erosion is comprised of soils where susceptibility to erosion is the dominant problem or hazard in their use. Table G-8 shows the distribution of erosive soils by land use in the Region.

Subclass "w" excess water is comprised of soils having excess water as the dominant hazard or problem in their use. Soils belonging in this subclass may have poor soil drainage, high water table, or overflow conditions. The distributions of soils in the Region with excess water is shown in Table G-9.

Subclass "s" unfavorable soil conditions includes soils that have limitations such as shallowness of root zones, low moisture holding capacity, stoniness or low fertility. The distribution of soils in the Region with unfavorable soil conditions is shown in Table G-10.

Interpretation of hazards and limitations does not evaluate the productivity of the land or determine suitability for specific kinds of crops.

TABLE G-4
LAND CAPABILITY CLASS DISTRIBUTION
BY LAND USE FOR BASINS OR AREAS
NORTH ATLANTIC REGION 1/

Land Capability Class	Percent Distribution	Land Use					
		Cropland	Pasture	Forest	Other	Urban	Total
		(Thousand Acres)					
1. St. John River, Maine							
I	0.2	1	-	-	-	-	1
II	15.0	155	7	521	5	-	688
III	5.3	61	3	178	5	-	247
IV	3.2	19	10	117	2	-	148
I-IV	23.7	236	20	816	12	-	1084
V	-	-	-	-	-	-	-
VI	63.4	4	4	2882	9	-	2899
VII	11.9	-	1	542	1	-	544
VIII	-	-	-	-	-	-	-
V-VIII	75.3	4	5	3424	10	-	3443
*	1.0	-	-	-	9	35	44
TOTAL	100.0	240	25	4240	31	35	4571
2. Penobscot River, Maine							
I	.1	3	-	1	1	-	5
II	8.0	138	17	235	12	-	402
III	2.1	31	10	62	6	-	109
IV	3.2	15	5	135	3	-	158
I-IV	13.4	187	32	433	22	-	674
V	-	-	-	-	-	-	-
VI	54.5	7	8	2738	5	-	2758
VII	29.44	2	1	1483	-	-	1486
VIII	.1	-	-	5	-	-	5
V-VIII	84.0	9	9	4226	5	-	4249
*	2.6	-	-	-	39	94	133
TOTAL	100.0	196	41	4659	66	94	5056
3. Kennebec River, Maine							
I	.5	7	1	8	-	-	16
II	12.6	168	25	254	5	-	452
III	6.5	62	14	156	2	-	234
IV	6.8	31	14	199	1	-	245
I-IV	26.4	268	54	617	8	-	947
V	-	-	-	-	-	-	-
VI	46.2	15	11	1623	1	-	1650
VII	24.5	4	5	859	6	-	874
VIII	-	-	-	-	-	-	-
V-VIII	70.7	19	16	2482	7	-	2524
*	2.9	-	-	-	8	96	104
TOTAL	100.0	287	70	3099	23	96	3575
4. Androscoggin River, Maine and New Hampshire							
I	.4	5	-	2	1	-	8
II	10.0	67	6	128	11	-	212
III	11.7	39	7	191	10	-	247
IV	3.3	9	3	55	3	-	70
I-IV	25.4	120	16	376	25	-	537
V	-	-	-	-	-	-	-
VI	38.7	12	8	791	7	-	818
VII	31.8	-	2	666	4	-	672
VIII	-	-	-	-	-	-	-
-VIII	70.5	12	10	1457	11	-	1490
*	4.1	-	-	-	-	86	86
TOTAL	100.0	132	26	1833	36	86	2113

Sheet 1 of 6

TABLE G-4
LAND CAPABILITY CLASS DISTRIBUTION
BY LAND USE FOR BASINS OR AREAS
NORTH ATLANTIC REGION 1/

Land Capability Class	Percent Distribution	Cropland	Pasture	Forest	Other	Urban	Total
		Land Use					
		(Thousand Acres)					
5. St. Croix River, Maine; and Atlantic Coastal Area From The International Boundary to Cape Small, Maine.							
I	.1	1	-	3	-	-	4
II	14.5	108	5	349	12	29	503
III	8.2	40	3	232	4	5	284
IV	5.4	21	2	152	3	5	183
I-IV	28.2	170	10	736	19	39	974
V	-	-	-	-	-	-	-
VI	49.1	34	4	1638	8	18	1702
VII	18.2	11	1	561	51	9	633
VIII	2.8	-	-	39	56	2	97
V-VIII	70.1	45	5	2238	115	29	2432
*	1.7	-	-	-	1	58	59
TOTAL	100.0	215	15	2974	135	126	3465
6. Presumpscot River, Maine; Saco River, Maine and New Hampshire; Piscataqua River, New Hampshire and Maine; and Atlantic Coastal Area From Cape Small, Maine to New Hampshire-Massachusetts State Line.							
I	.8	8	-	6	4	2	20
II	19.7	94	9	301	63	19	486
III	12.1	32	8	219	25	16	300
IV	6.2	20	5	116	14	-	155
I-IV	38.8	154	22	642	106	37	961
V	-	-	-	-	-	-	-
VI	41.1	15	11	958	28	4	1016
VII	15.5	1	1	366	8	6	382
VIII	.6	-	-	2	9	3	14
V-VIII	57.2	16	12	1326	45	13	1412
*	4.0	-	-	2	4	92	98
TOTAL	100.0	170	34	1970	155	142	2471
7. Merrimack River, New Hampshire and Massachusetts.							
I	.6	8	1	5	3	2	19
II	7.0	75	10	84	32	15	216
III	8.8	40	6	162	35	28	271
IV	3.4	17	5	67	10	6	105
I-IV	19.8	140	22	318	80	51	611
V	-	-	-	-	-	-	-
VI	31.5	21	15	870	47	15	968
VII	41.0	6	20	1180	32	16	1254
VIII	1.5	-	-	17	11	19	47
V-VIII	74.0	27	35	2067	90	50	2269
*	6.2	1	-	5	18	172	196
TOTAL	100.0	168	57	2390	188	273	3076
8. Connecticut River, Vermont, New Hampshire, Massachusetts and Connecticut.							
I	1.4	62	9	18	6	2	97
II	7.4	241	50	149	59	17	516
III	6.7	145	50	206	48	16	465
IV	5.6	102	65	180	37	4	388
I-IV	21.1	550	174	553	150	39	1466
V	.6	3	6	25	8	-	42
VI	21.4	18	39	1406	25	3	1491
VII	52.6	26	122	3465	46	2	3661
VIII	.7	-	-	39	7	6	52
V-VIII	75.3	47	167	4935	86	11	5246
*	3.6	1	-	1	36	208	246
TOTAL	100.0	598	341	5489	272	258	6958

TABLE G-4
LAND CAPABILITY CLASS DISTRIBUTION
BY LAND USE FOR BASINS OR AREAS
NORTH ATLANTIC REGION 1/

Land Capability Class	Percent Distribution	Land Use					
		Cropland	Pasture	Forest	Other	Urban	Total
				(Thousand Acres)			
9. Narragansett Bay Drainage, Massachusetts and Rhode Island; Pawcatuck River, Rhode Island and Connecticut; and Atlantic Coastal Area From New Hampshire-Massachusetts State Line to Rhode Island-Connecticut State Line.							
I	2.8	17	1	40	10	6	74
II	10.8	59	18	133	43	31	284
III	12.6	17	3	237	50	23	330
IV	9.4	9	10	204	21	3	247
I-IV	35.6	102	32	614	124	63	935
V	.7	-	-	17	1	-	18
VI	11.1	21	11	230	12	16	290
VII	29.8	22	16	696	27	19	780
VIII	5.3	-	-	54	82	2	138
V-VIII	46.9	43	27	997	122	37	1226
*	17.5	-	-	5	34	418	457
TOTAL	100.0	145	59	1616	280	518	2618
10. Thames River, Connecticut, Massachusetts and Rhode Island; Housatonic River, Connecticut, Massachusetts and New York; and Connecticut Coastal Area.							
I	1.3	18	3	8	6	4	39
II	13.2	131	40	112	68	22	373
III	6.4	42	17	71	32	17	179
IV	14.7	31	42	282	52	6	413
I-IV	35.6	222	102	473	158	49	1004
V	2.6	2	6	53	11	-	72
VI	19.2	10	28	464	29	7	538
VII	30.7	3	22	816	21	2	864
VIII	4.6	-	1	114	15	1	131
V-VIII	57.1	15	57	1447	76	10	1605
*	7.3	-	-	2	11	190	203
TOTAL	100.0	237	159	1922	245	249	2812
11. St. Lawrence River, New York; and Lake Champlain, Vermont and New York.							
I	.5	25	6	3	2	-	36
II	9.9	461	135	72	36	-	704
III	18.0	470	192	522	104	-	1288
IV	8.7	214	160	188	59	-	621
I-IV	37.1	1170	493	785	201	-	2649
V	.3	2	3	14	2	-	21
VI	20.3	20	138	1232	58	-	1448
VII	28.2	26	249	1691	47	-	2013
VIII	12.1	4	36	705	121	-	866
V-VIII	60.9	52	426	3642	228	-	4348
*	2.0	-	1	-	10	132	143
TOTAL	100.0	1222	920	4427	439	132	7140
12. Hudson River, New York, Vermont and Massachusetts.							
I	2.1	89	13	20	22	27	171
II	13.8	491	123	334	162	36	1146
III	16.5	416	170	577	175	32	1370
IV	13.2	243	168	528	147	14	1100
I-IV	45.6	1239	474	1459	506	109	3787
V	.1	-	-	1	-	-	1
VI	15.9	36	146	1027	100	9	1318
VII	34.6	21	81	2689	61	22	2874
VIII	.6	-	3	25	24	-	52
V-VIII	51.2	57	230	3742	185	31	4245
*	3.2	-	-	1	10	250	261
TOTAL	100.0	1296	704	5202	701	390	8293

TABLE G-4
LAND CAPABILITY CLASS DISTRIBUTION
BY LAND USE FOR BASINS OR AREAS
NORTH ATLANTIC REGION 1/

	Land Capability Class	Percent Distribution	Land Use					
			Cropland	Pasture	Forest	Other	Urban	Total
			(Thousand Acres)					
13.	New York City; Long Island; and Westchester County Coastal Area							
	I	9.4	28	-	45	9	18	100
	II	11.1	26	2	59	20	10	117
	III	5.5	7	1	38	5	8	59
	IV	2.9	1	1	20	7	-	29
	I-IV	28.9	62	4	162	41	36	305
	V	-	-	-	-	-	-	-
	VI	1.0	-	-	8	2	-	10
	VII	21.0	1	-	188	24	8	221
	VIII	1.3	-	-	3	10	-	13
	V-VIII	23.3	1	-	199	36	8	244
	*	47.8	-	-	-	-	504	504
	TOTAL	100.0	63	4	361	77	548	1053
14.	Passaic River, New Jersey and New York; Raritan River, New Jersey; and Other Northern New Jersey Streams.							
	I	1.4	13	1	3	1	3	21
	II	11.7	70	12	38	32	21	173
	III	22.5	109	14	111	67	29	330
	IV	8.4	28	10	57	27	2	124
	I-IV	44.0	220	37	209	127	55	648
	V	-	-	-	-	-	-	-
	VI	12.8	8	7	159	10	4	188
	VII	13.9	1	1	187	13	4	206
	VIII	2.7	-	-	32	6	-	38
	V-VIII	29.4	9	8	378	29	8	432
	*	26.6	-	-	1	6	385	392
	TOTAL	100.0	229	45	588	162	448	1472
15.	Delaware River and Delaware Bay, New York, New Jersey, Pennsylvania and Delaware							
	I	2.0	103	7	34	15	2	161
	II	20.6	911	118	409	194	8	1640
	III	18.2	489	129	647	177	6	1448
	IV	6.7	162	64	232	77	1	536
	I-IV	47.5	1665	318	1322	463	17	3785
	V	.3	2	5	11	5	-	23
	VI	20.8	88	87	1413	71	2	1661
	VII	16.8	50	48	1172	71	-	1341
	VIII	3.7	4	1	114	168	-	287
	V-VIII	41.6	144	141	2710	315	2	3312
	*	10.9	2	-	16	70	780	868
	TOTAL	100.0	1811	459	4048	848	799	7965
16.	Atlantic Coastal Area From Sandy Hook, New Jersey to Cape May, New Jersey.							
	I	3.2	17	-	27	1	-	45
	II	15.2	97	5	105	8	-	215
	III	32.0	78	10	341	22	-	451
	IV	3.8	3	1	42	7	-	53
	I-IV	54.2	195	16	515	38	-	764
	V	-	-	-	-	-	-	-
	VI	1.4	4	3	11	1	-	19
	VII	17.9	13	2	230	8	-	253
	VIII	11.3	-	-	4	155	-	159
	V-VIII	30.6	17	5	245	164	-	431
	*	15.2	-	-	-	10	204	214
	TOTAL	100.0	212	21	760	212	204	1409

Sheet 4 of 6

TABLE G-4
LAND CAPABILITY CLASS DISTRIBUTION
BY LAND USE FOR BASINS OR AREAS
NORTH ATLANTIC REGION 1/

Land Capability Class	Percent Distribution	Land Use: Cropland	Pasture	Forest	Other	Urban	Total
		(Thousand Acres)					
17. Susquehanna River, New York, Pennsylvania and Maryland.							
I	1.5	181	25	34	14	-	254
II	16.8	1532	238	911	235	-	2916
III	17.7	1202	426	1106	340	-	3074
IV	14.8	733	386	1172	282	-	2573
I-IV	50.8	3648	1075	3223	871	-	8817
V		-	1	4	-	-	5
VI	20.4	270	263	2859	184	-	3576
VII	20.9	99	134	3297	117	-	3647
VIII	1.9	1	1	316	7	-	325
V-VIII	43.2	370	399	6476	308	-	7553
*	6.0	1	-	80	73	883	1037
TOTAL	100.0	4019	1474	9779	1252	883	17407
18. Patuxent River, Maryland; Nanticoke River, Maryland and Delaware; Delmarva Peninsula From Cape Henlopen, Delaware to Cape Charles, Virginia; and Chesapeake Bay Drainage From Cape Charles, Virginia to Point Lookout, Maryland.							
I	6.0	207	8	50	14	-	279
II	29.9	858	63	367	102	-	1390
III	33.6	574	59	832	96	-	1561
IV	4.1	57	16	95	17	-	185
I-IV	73.6	1696	146	1344	229	-	3415
V	.1	-	-	5	4	-	9
VI	7.5	52	46	222	29	-	349
VII	4.2	13	13	152	16	-	194
VIII	9.7	5	4	17	428	-	454
V-VIII	21.5	70	63	396	477	-	1006
*	4.9	-	-	-	1	228	229
TOTAL	100.0	1766	209	1740	707	228	4650
19. Potomac River, Maryland, Virginia, West Virginia, Pennsylvania and District of Columbia.							
I	1.5	81	21	26	9	-	137
II	18.4	762	259	537	143	-	1701
III	20.2	530	284	892	161	-	1867
IV	13.7	250	210	687	120	-	1267
I-IV	53.8	1623	774	2142	433	-	4972
V	1.0	13	9	63	5	-	90
VI	12.3	121	165	808	49	-	1143
VII	27.3	65	198	2194	72	-	2529
VIII	1.5	1	2	81	58	-	142
V-VIII	42.1	200	374	3146	184	-	3904
*	4.1	-	-	1	7	373	381
TOTAL	100.0	1823	1148	5289	624	373	9257
20. Rappahannock River, Virginia; York River, Virginia; and Chesapeake Bay Drainage From Smith Point, Virginia to Old Point Comfort, Virginia.							
I	4.0	60	4	81	5	-	150
II	34.5	295	109	810	73	-	1287
III	21.3	127	78	548	43	-	796
IV	7.6	48	66	154	16	-	284
I-IV	67.4	530	257	1593	137	-	2517
V	4.9	10	19	150	3	-	182
VI	7.6	19	48	209	9	-	285
VII	14.5	18	35	480	9	-	542
VIII	2.4	5	-	9	75	-	89
V-VIII	29.4	52	102	848	96	-	1098
*	3.2	-	-	-	5	116	121
TOTAL	100.0	582	359	2441	238	116	3736

TABLE G-4
LAND CAPABILITY CLASS DISTRIBUTION
BY LAND USE FOR BASINS OR AREAS
NORTH ATLANTIC REGION 1/

Land Capability Class	Percent Distribution	Land Use: Cropland	Pasture	Forest	Other	Urban	Total
		(Thousand Acres)					
21. James River, Virginia and West Virginia; and Chesapeake Bay and Atlantic Coastal Drainage From Old Point Comfort, Virginia to Virginia Beach, Virginia.							
I	.6	21	7	12	3	-	43
II	25.4	333	116	1173	66	-	1688
III	20.9	161	106	1075	45	-	1387
IV	11.7	79	117	550	31	-	777
I-IV	58.6	594	346	2810	145	-	3895
V	2.5	3	7	155	1	-	166
VI	10.5	28	91	562	13	-	694
VII	22.4	11	88	1380	11	-	1490
VIII	.7	-	-	9	38	-	47
V-VIII	36.1	42	186	2106	63	-	2397
*	5.3	-	-	-	1	346	347
TOTAL	100.0	636	532	4916	209	346	6639

1/ Based on hydrologic units.

* Area reported without a land capability classification.

Source: USDA Conservation Needs Inventory, 1958; adjusted to hydrologic units.

TABLE G-5
DISTRIBUTION OF LAND USE BY LAND CAPABILITY CLASS 1/
NORTH ATLANTIC REGION

Class	Percent Distribution	Percent of Classes by Land Use: Cropland	Pasture	Forest	Other	Urban
I	1.6	57	7	25	7	4
II	16.2	41	8	42	8	1
III	15.4	29	10	51	9	1
IV	9.1	21	14	54	10	1
Total I-IV	42.3	33	10	47	9	1
V	.6	5	9	79	6	1
VI	23.5	3	5	88	3	1
VII	25.0	1	4	92	2	1
VIII	2.8	1	1	54	43	1
Total V-VIII	51.9	2	4	88	5	1
*	5.8	1	1	2	6	90
Percent of Agricultural land	-	16	7	70	7	-

TABLE G-6
LAND CAPABILITY CLASSES BY LAND USE 1/
NORTH ATLANTIC REGION

Class	Cropland	Pasture	Forest	Other	Urban	Total
		(Thousand Acres)				
I	955	107	426	126	66	1,680
II	7,073	1,367	7,080	1,381	208	17,109
III	4,672	1,590	8,403	1,452	180	16,297
IV	2,092	1,360	5,232	936	41	9,661
Total I-IV	14,792	4,424	21,141	3,895	495	44,747
V	35	56	498	40	-	629
VI	803	1,133	22,110	697	78	24,821
VII	392	1,040	24,295	645	88	26,460
VIII	20	48	1,585	1,270	33	2,956
Total V-VIII	1,250	2,277	48,488	2,652	199	54,866
*	5	1	114	353	5,650	6,123
TOTAL	16,047	6,702	69,743	6,900	6,344	105,736

* Area reported without a land capability class.
1/ Based on hydrologic units of the Basin.

Source: USDA Conservation Needs Inventory, 1958; adjusted to hydrologic units.

TABLE G-7

AMOUNT AND GEOGRAPHIC DISTRIBUTION OF LAND BY CAPABILITY CLASSES 1/
NORTH ATLANTIC REGION.

Subregion and Area	Land Capability Classes								
	I	II	III	IV	V	VI	VII	VIII	*
					Percent				
Subregion A									
1	.1	4.1	1.5	1.5	-	11.7	2.1	-	.7
2	.3	2.4	.7	1.6	-	11.1	5.6	.2	2.2
3	.9	2.6	1.5	2.5	-	6.6	3.3	-	1.7
4	.5	1.2	1.5	.8	-	3.3	2.5	-	1.4
5	.2	2.9	1.7	1.9	-	6.9	2.3	3.3	1.0
Subtotal A	2.0	13.2	6.9	8.3	-	39.6	15.8	3.5	7.0
Subregion B									
6	1.1	2.8	1.8	1.6	-	4.1	1.4	.5	1.6
7	1.1	1.3	1.7	1.1	-	3.9	3.7	1.6	3.2
8	5.8	3.0	2.8	4.0	6.6	6.1	4.7	1.8	4.0
9	4.4	1.6	2.0	2.5	2.9	1.2	13.8	4.7	7.5
10	2.3	2.2	1.2	4.3	11.6	2.2	2.9	4.3	3.3
Subtotal B	14.7	10.9	9.5	13.5	21.1	17.3	26.5	12.9	19.6
Subregion C									
11	2.2	4.1	7.9	6.4	3.3	5.8	7.6	29.3	2.3
12	10.1	6.7	8.4	11.4	.2	5.3	10.9	1.8	4.3
13	5.9	.7	.4	.3	-	.1	.8	.4	8.2
Subtotal C	18.2	11.5	16.7	18.1	3.5	11.2	19.3	31.5	14.8
Subregion D									
14	1.2	1.0	2.0	1.3	-	.8	.8	1.3	6.4
15	9.6	9.6	8.9	5.5	3.7	6.7	5.1	9.7	14.2
16	2.7	1.2	2.8	.6	-	.1	.9	5.4	3.5
Subtotal D	13.5	11.8	13.7	7.4	3.7	7.6	6.8	16.4	24.1
Subregion E									
17	15.2	17.1	18.9	26.6	.8	14.4	13.8	11.0	16.9
18	16.7	8.2	9.4	1.9	1.4	1.4	.6	15.3	3.7
Subtotal E	31.9	25.3	28.3	28.5	2.2	15.8	14.4	26.3	20.6
Subregion F									
19	8.2	9.9	11.5	13.1	14.2	4.6	9.6	4.8	6.2
20	8.9	7.5	4.9	2.9	28.9	1.1	2.0	3.0	2.0
21	2.6	9.9	8.5	8.2	26.4	2.8	5.6	1.6	5.7
Subtotal F	19.7	27.3	24.9	24.2	69.5	8.5	17.2	9.4	13.9
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
TOTAL ACRES (thousands)	1680	17109	16297	9661	629	24821	26460	2956	6123

1/ Based on hydrologic units.

* Area reported without a land capability classification.

Source: USDA Conservation Needs Inventory, 1958; adjusted to hydrologic units.

TABLE G-8
USE OF SOIL WITH EROSION HAZARD 1/
NORTH ATLANTIC REGION

Subregion and Region	Crop-land	Pasture	Forest	Other Land	Urban	Total "e" Soils 1/
			1000 acres			
Subregion A						
1	104	3	297	4	-	408
2	53	9	67	7	-	136
3	104	19	73	2	-	198
4	52	5	62	10	-	129
5	60	3	194	5	31	293
Subtotal A	373	39	693	28	31	1164
Subregion B						
6	86	14	168	50	19	337
7	73	9	65	31	17	195
8	254	103	252	59	8	676
9	41	10	73	28	16	168
10	103	34	122	56	18	333
Subtotal B	557	170	680	224	78	1709
Subregion C						
11	540	245	245	73	-	1103
12	804	333	1467	302	58	2964
13	15	2	45	20	3	85
Subtotal C	1359	580	1757	395	61	4152
Subregion D						
14	142	17	100	65	27	351
15	1206	231	846	316	10	2609
16	68	6	63	8	-	145
Subtotal D	1416	254	1009	389	37	3105
Subregion E						
17	3185	930	4002	831	-	8948
18	753	124	513	144	-	1534
Subtotal E	3938	1054	4515	975	-	10482
Subregion F						
19	1364	775	3165	376	-	5680
20	321	257	1512	103	-	2193
21	439	382	2932	130	-	3883
Subtotal F	2124	1414	7609	609	-	11756
REGION TOTAL	9767	3511	16263	2620	207	32368

1/ Erosion hazard is indicated in SCS Land Capability Subclass "e" - soils subject to erosion by wind or water.

TABLE G-9
USE OF SOIL WITH WETNESS HAZARD 1/
NORTH ATLANTIC REGION

Subregion and Region	Crop-land	Pasture	Forest	Other Land	Urban	Total "w" Soils 1/
			1000 acres			
Subregion A						
1	57	15	1048	11	-	1131
2	55	14	402	14	-	485
3	108	27	429	10	-	574
4	32	6	172	10	-	220
5	60	6	515	119	4	704
Subtotal A	312	68	2566	164	4	3114
Subregion B						
6	44	6	340	51	3	444
7	35	9	225	48	7	324
8	156	56	292	88	11	603
9	39	17	348	102	8	514
10	68	49	254	70	7	448
Subtotal B	342	137	1459	359	36	2333
Subregion C						
11	560	248	555	159	-	1522
12	278	187	584	200	10	1259
13	1	1	15	13	-	30
Subtotal C	839	436	1154	372	10	2801
Subregion D						
14	56	22	178	68	21	345
15	328	128	576	333	5	1370
16	54	10	309	166	-	539
Subtotal D	438	160	1063	567	26	2254
Subregion E						
17	528	346	657	221	-	1752
18	634	73	958	503	-	2168
Subtotal E	1162	419	1615	724	-	3920
Subregion F						
19	257	159	617	128	-	1161
20	116	65	517	108	-	806
21	95	53	667	54	-	869
Subtotal F	468	277	1801	290	-	2836
REGION TOTAL	3561	1497	9658	2476	76	17268

1/ Wetness hazard is indicated in SCS Land Capability Subclass "w" - excess water in or on the surface.

TABLE G-10
USE OF SOIL WITH UNFAVORABLE SOIL CONDITIONS 1/
NORTH ATLANTIC REGION

Subregion and Area	Crop-land	Pasture	Forest	Other Land	Urban	Total "s" Soils 1/
			1000 acres			
Subregion A						
1	79	6	2895	6	-	2986
2	84	18	4189	5	-	4296
3	68	23	2589	3	-	2683
4	44	15	1597	16	-	1672
5	94	6	2262	11	33	2406
Subtotal A	369	68	13532	41	33	14043
Subregion B						
6	32	14	1454	50	26	1576
7	51	37	2091	88	76	2343
8	126	172	4925	83	29	5335
9	48	31	1150	106	71	1406
10	48	73	1536	102	29	1788
Subtotal B	305	327	11156	429	231	12448
Subregion C						
11	96	420	3624	195	-	4335
12	126	170	3129	167	46	3638
13	19	1	256	34	23	333
Subtotal C	241	591	7009	396	69	8306
Subregion D						
14	18	4	306	22	11	361
15	173	93	2575	114	2	2957
16	73	5	361	27	-	466
Subtotal D	264	102	3242	163	13	3784
Subregion E						
17	124	173	5005	112	-	5414
18	167	4	220	44	-	435
Subtotal E	291	177	5225	156	-	5849
Subregion F						
19	121	193	1480	104	-	1898
20	85	32	331	18	-	466
21	81	91	1305	20	-	1497
Subtotal F	287	316	3116	142	-	3861
REGION TOTAL	1757	1581	43280	1327	346	48291

1/ Unfavorable soil conditions are indicated in SCS Land Capability subclass "s" - soils that limit root development or have low moisture holding capacity.

LAND USE

A study of resource use and availability begins with an inventory and evaluation of the resources. A part of this objective was achieved during the late 1950's. At that time a national inventory was made of the land and water resources of the United States. This became known as the Conservation Needs Inventory (CNI) (1). This inventory was conducted primarily by the SCS with the assistance of numerous state and federal agencies. Two of the many purposes of this inventory were to determine the use of land resources and to determine the water surface area for bodies of water under 40 acres in size. The CNI data were supplemented with data from other sources to show the total land and water surface areas of the various river basins of the NAR, the acres of urban land, and the water surface areas over 40 acres in size. The inventory of the land and water resources is basic in the planning for the wise and judicial use and management of the resources. The NAR was divided into 21 hydrologic units shown in Figure G-1 and the acreage data by area by land use are shown in Table G-11. The Land Use by States is shown in Table G-12. The acreages shown are based on the CNI survey and other supplementary studies and sources of information.

Present Use by Type

The land area of the NAR is classified within five categories, Cropland, Pasture, Forest, Urban, and Other, as follows:

	Acres Thousands	Percent
Cropland	16,047	15.2
Pasture	6,702	6.3
Forest	69,743	66.0
Other	6,900	6.5
Urban	6,344	6.0
	105,736	100.0

Regional land use within land capability class is illustrated in Figure G-6.

Cropland. Cropland is land currently tilled including cropland harvested, crop failure, summer fallow, idle cropland, cropland in cover crops or soil-improvement crops not harvested nor pastured, rotation pasture, and cropland being prepared for crops. All tame hay was included as cropland.

The major crops produced are corn, white potatoes, tobacco, soy beans, fruit and vegetables and to a limited extent, sweet potatoes and small grains. Forage crops for dairy farming are also grown.

The agricultural development in the humid NAR is centered around dairying. In the northern part of the Region the short growing season and cool climate favor dairy farming and potato production.

TABLE G-11

LAND USE AND WATER AREA[1] BY SUBREGION, [2]
AND AREA, NORTH ATLANTIC REGION, 1963.

Subregion, Area and State	Cropland	Pasture	Forest	Other	Urban [3]	Total Land Area	Water Area Under: 40	Water Area Over 40	Total Land and Water Area
				Thousand Acres					
Subregion A									
Area 1									
Maine	240	25	4,240	31	35	4,571	10	129	4,710
Area 2									
Maine	196	41	4,659	66	94	5,056	20	380	5,456
Area 3									
Maine	287	70	3,099	23	96	3,575	7	175	3,757
Area 4									
Maine	124	24	1,408	35	76	1,667	8	72	1,747
New Hampshire	8	2	425	1	10	446	5	10	461
Subtotal	132	26	1,833	36	86	2,113	13	82	2,208
Area 5									
Maine	215	15	2,974	135	126	3,465	8	515	3,988
TOTALS	1,070	177	16,805	291	437	18,780	58	1,281	20,119
Subregion B									
Area 6									
Maine	129	25	1,045	90	112	1,401	9	189	1,599
New Hampshire	41	9	920	64	29	1,063	6	16	1,085
Massachusetts	0	0	5	1	1	7	0	1	8
Subtotal	170	34	1,970	155	142	2,471	15	206	2,692
Area 7									
New Hampshire	98	27	1,988	110	107	2,330	15	113	2,458
Massachusetts	70	30	402	78	166	746	5	23	774
Subtotal	168	57	2,390	188	273	3,076	20	136	3,232
Area 8									
New Hampshire	111	50	1,686	41	21	1,909	7	34	1,950
Vermont	201	160	2,043	60	24	2,488	11	15	2,514
Massachusetts	164	86	1,247	78	101	1,676	13	55	1,744
Connecticut	122	45	513	93	112	885	11	24	920
Subtotal	598	341	5,489	272	258	6,958	42	128	7,128
Area 9									
Massachusetts	100	40	1,192	216	410	1,958	19	178	2,155
Connecticut	5	3	25	2	1	36	0	0	36
Rhode Island	40	16	399	62	107	624	9	104	737
Subtotal	145	59	1,616	280	518	2,618	28	282	2,928
Area 10									
Massachusetts	35	14	352	24	38	463	7	11	481
Connecticut	171	131	1,431	203	204	2,140	21	65	2,226
Rhode Island	1	1	35	2	0	39	0	0	39
New York	30	13	104	16	7	170	0	0	170
Subtotal	237	159	1,922	245	249	2,812	28	76	2,916
TOTALS	1,318	650	13,387	1,140	1,440	17,935	133	828	18,896
Subregion C									
Area 11									
Vermont	767	652	1,483	161	70	3,133	15	199	3,347
New York	455	268	2,944	278	62	4,007	29	233	4,269
Subtotal	1,222	920	4,427	439	132	7,140	44	432	7,616

TABLE G-11

LAND USE AND WATER AREA 1/ BY SUBREGION, 2/
AND AREA, NORTH ATLANTIC REGION, 1963.

Subregion Area and State	Cropland	Pasture	Forest	Other	Urban 3/	Total Land Area	Water Area Under 40	Water Area Over 40	Total Land and Water Area
				Thousand Acres					
Area 12									
New Jersey	17	19	68	18	26	148	2	13	163
Vermont	40	29	204	9	5	287	1	0	288
Massachusetts	9	7	90	3	8	117	2	3	122
New York	1,229	649	4,819	670	351	7,718	33	207	7,958
Connecticut	1	0	21	1	0	23	0	0	23
Subtotal	1,296	704	5,202	701	390	8,293	38	223	8,554
Area 13									
New York	63	4	361	77	548	1,053	1	163	1,217
TOTALS	2,581	1,628	9,990	1,217	1,070	16,486	83	818	17,387
Subregion D									
Area 14									
New Jersey	222	43	538	156	426	1,385	7	28	1,420
New York	7	2	50	6	22	87	1	12	100
Subtotal	229	45	588	162	448	1,472	8	40	1,520
Area 15									
New York	118	103	1,121	97	38	1,477	12	23	1,512
New Jersey	460	90	863	270	173	1,856	12	32	1,900
Pennsylvania	930	248	1,968	368	522	4,036	20	54	4,110
Delaware	303	18	92	112	66	591	7	44	642
Maryland	0	0	4	1	0	5	0	0	5
Subtotal	1,811	459	4,048	848	799	7,965	51	153	8,169
Area 16									
New Jersey	212	21	760	212	204	1,409	2	121	1,532
TOTALS	2,252	525	5,396	1,222	1,451	10,846	61	314	11,221
Subregion E									
Area 17									
New York	986	739	1,676	438	156	3,995	21	22	4,038
Pennsylvania	2,985	704	8,025	807	723	13,244	53	96	13,393
Maryland	48	31	78	7	4	168	1	7	176
Subtotal	4,019	1,474	9,779	1,252	883	17,407	75	125	17,607
Area 18									
Delaware	278	5	300	57	29	669	2	3	674
Pennsylvania	22	6	13	6	1	48	0	0	48
Maryland	1,350	192	1,297	483	171	3,493	22	362	3,877
Virginia	116	6	130	161	27	440	5	169	614
Subtotal	1,766	209	1,740	707	228	4,650	29	534	5,213
TOTALS	5,785	1,683	11,519	1,959	1,111	22,057	104	659	22,820

Sheet 2 of 3

TABLE G-11

LAND USE AND WATER AREA 1/ BY SUBREGION, AND AREA, NORTH ATLANTIC REGION, 1963. 2/

Subregion Area and State	Cropland	Pasture	Forest	Other	Urban 3/	Total Land Area	Water Area Under 40	Water Area Over 40	Total Land and Water Area
	Thousand Acres								
Subregion F									
Area 19									
Pennsylvania	314	66	520	88	12	1,000	4	1	1,005
Maryland & D.C.	603	216	1,331	133	130	2,413	4	70	2,487
Virginia	663	583	1,822	327	226	3,621	9	33	3,663
West Virginia	243	283	1,616	76	5	2,223	9	2	2,234
Subtotal	1,823	1,148	5,289	624	373	9,257	26	106	9,389
Area 20									
Virginia	582	359	2,441	238	116	3,736	10	94	3,840
Area 21									
Virginia	635	526	4,894	209	346	6,610	14	131	6,755
West Virginia	1	6	22	0	0	29	0	0	29
Subtotal	636	532	4,916	209	346	6,639	14	131	6,784
TOTALS	3,041	2,039	12,646	1,071	835	19,632	50	331	20,013
GRAND TOTAL NAR	16,047	6,702	69,743	6,900	6,344	105,736	489	4,231	110,456

1/ Definitions of the various land uses and water areas may be found on pages G-37 through G-48.

2/ Land and water areas were based on the drainage basins of the 21 hydrologic areas delineated for the North Atlantic Study. These were further grouped into six major subregions. Definitions of these 21 areas and six major subregions are shown in Figure G-1.

3/ The portions of county urban and water acreage, both water bodies over and under 40 acres, were estimated in those counties which do not lie entirely within one drainage basin. Road maps and drainage maps were used to locate urban places and bodies of water.

Sources of Data: Land use with the exception of urban land was obtained from the Conservation Needs Inventory of 1958, conducted by the Soil Conservation Service with the assistance of other agencies of the United States Department of Agriculture and various State agencies. Urban land and water areas over 40 acres were obtained from the "Area Measurement Reports" and the "Statistical Abstract" of the United States Department of Commerce. Water areas under 40 acres were obtained from the Conservation Needs Inventory. The data were updated to reflect historical trends of the Census of Agriculture and the most recent data of the Forest Survey conducted by the Forest Service of the United States Department of Agriculture. Total areas for each basin were obtained from previously published reports.

Sheet 3 of 3

TABLE G-12

LAND USE AND WATER AREA[1/]
BY STATE , AND AREA, NORTH ATLANTIC REGION, 1963.[2/]

State and Area	Cropland	Pasture	Forest	Other	Urban 3/	Total Land Area	Water Area Under 40	Water Area Over 40	Total Land and Water Area
					Thousand Acres				
Maine									
Area A-1	240	25	4,240	31	35	4,571	10	129	4,710
A-2	196	41	4,659	66	94	5,056	20	380	5,456
A-3	287	70	3,099	23	96	3,575	7	175	3,757
A-4	124	24	1,408	35	76	1,667	8	72	1,747
A-5	215	15	2,974	135	126	3,465	8	515	3,988
B-6	129	25	1,045	90	112	1,401	9	189	1,599
TOTALS	1,191	200	17,425	380	539	19,735	62	1,460	21,257
New Hampshire									
Area A-4	8	2	425	1	10	446	5	10	461
B-6	41	9	920	64	29	1,063	6	16	1,085
B-7	98	27	1,988	110	107	2,330	15	113	2,458
B-8	111	50	1,686	41	21	1,909	7	34	1,950
TOTALS	258	88	5,019	216	167	5,748	33	173	5,954
Vermont									
Area B-8	201	160	2,043	60	24	2,488	11	15	2,514
C-11	767	652	1,483	161	70	3,133	15	199	3,347
C-12	40	29	204	9	5	287	1	0	288
TOTALS	1,008	841	3,730	230	99	5,908	27	214	6,149
Massachusetts									
Area B-6	0	0	5	1	1	7	0	1	8
B-7	70	30	402	78	166	746	5	23	774
B-8	164	86	1,247	78	101	1,676	13	55	1,744
B-9	100	40	1,192	216	410	1,958	19	178	2,155
B-10	35	14	352	24	38	463	7	11	481
C-12	9	7	90	3	8	117	2	3	122
TOTALS	378	177	3,288	400	724	4,967	46	271	5,284
Connecticut									
Area B-8	122	45	513	93	112	885	11	24	920
B-9	5	3	25	2	1	36	0	0	36
B-10	171	131	1,431	203	204	2,140	21	65	2,226
C-12	1	0	21	1	0	23	0	0	23
TOTALS	299	179	1,990	299	317	3,084	32	89	3,205
Rhode Island									
Area B-9	40	16	399	62	107	624	9	104	737
B-10	1	1	35	2	0	39	0	0	39
TOTALS	41	17	434	64	107	663	9	104	776
New York									
Area B-10	30	13	104	16	7	170	0	0	170
C-11	455	268	2,944	278	62	4,007	29	233	4,269
C-12	1,229	649	4,819	670	351	7,718	33	207	7,958
C-13	63	4	361	77	548	1,053	1	163	1,217
D-14	7	2	50	6	22	87	1	12	100
D-15	118	103	1,121	97	38	1,477	12	23	1,512
E-17	986	739	1,676	438	156	3,995	21	22	4,038
TOTALS	2,888	1,778	11,075	1,582	1,184	18,507	97	660	19,264
New Jersey									
Area C-12	17	19	68	18	26	148	2	13	163
D-14	222	43	538	156	426	1,385	7	28	1,420
D-15	460	90	863	270	173	1,856	12	32	1,900
D-16	212	21	760	212	204	1,409	2	121	1,532
TOTALS	911	173	2,229	656	829	4,798	23	194	5,015

Sheet 1 of 2

TABLE G-12

LAND USE AND WATER AREA 1/
BY STATE , AND AREA, NORTH ATLANTIC REGION, 1963. 2/

State and Area	Cropland	Pasture	Forest	Other	Urban 3/	Total Land Area	Water Area Under 40	Water Area Over 40	Total Land and Water Area
	Thousand Acres								
Delaware									
Area D-15	303	18	92	112	66	591	7	44	642
E-18	278	5	300	57	29	669	2	3	674
TOTALS	581	23	392	169	95	1,260	9	47	1,316
Pennsylvania									
Area D-15	930	248	1,968	368	522	4,036	20	54	4,110
E-17	2,985	704	8,025	807	723	13,244	53	96	13,393
E-18	22	6	13	6	1	48	0	0	48
F-19	314	66	520	88	12	1,000	4	1	1,005
TOTALS	4,251	1,024	10,526	1,269	1,258	18,328	77	151	18,556
Maryland and District of Columbia									
Area D-15	0	0	4	1	0	5	0	0	5
E-17	48	31	78	7	4	168	1	7	176
E-18	1,350	192	1,297	483	171	3,493	22	362	3,877
F-19 & D.C.	603	216	1,331	133	130	2,413	4	70	2,487
TOTALS	2,001	439	2,710	624	305	6,079	27	439	6,545
Virginia									
Area E-18	116	6	130	161	27	440	5	169	614
F-19	663	583	1,822	327	226	3,621	9	33	3,663
F-20	582	359	2,441	238	116	3,736	10	94	3,840
F-21	635	526	4,894	209	346	6,610	14	131	6,755
TOTALS	1,996	1,474	9,287	935	715	14,407	38	427	14,872
West Virginia									
Area F-19	243	283	1,616	76	5	2,223	9	2	2,234
F-21	1	6	22	0	0	29	0	0	29
TOTALS	244	289	1,638	76	5	2,252	9	2	2,263
GRAND TOTAL NAR	16,047	6,702	69,743	6,900	6,344	105,736	489	4,231	110,456

1/ Definitions of the various land uses and water areas may be found on pages G-37 through G-48.

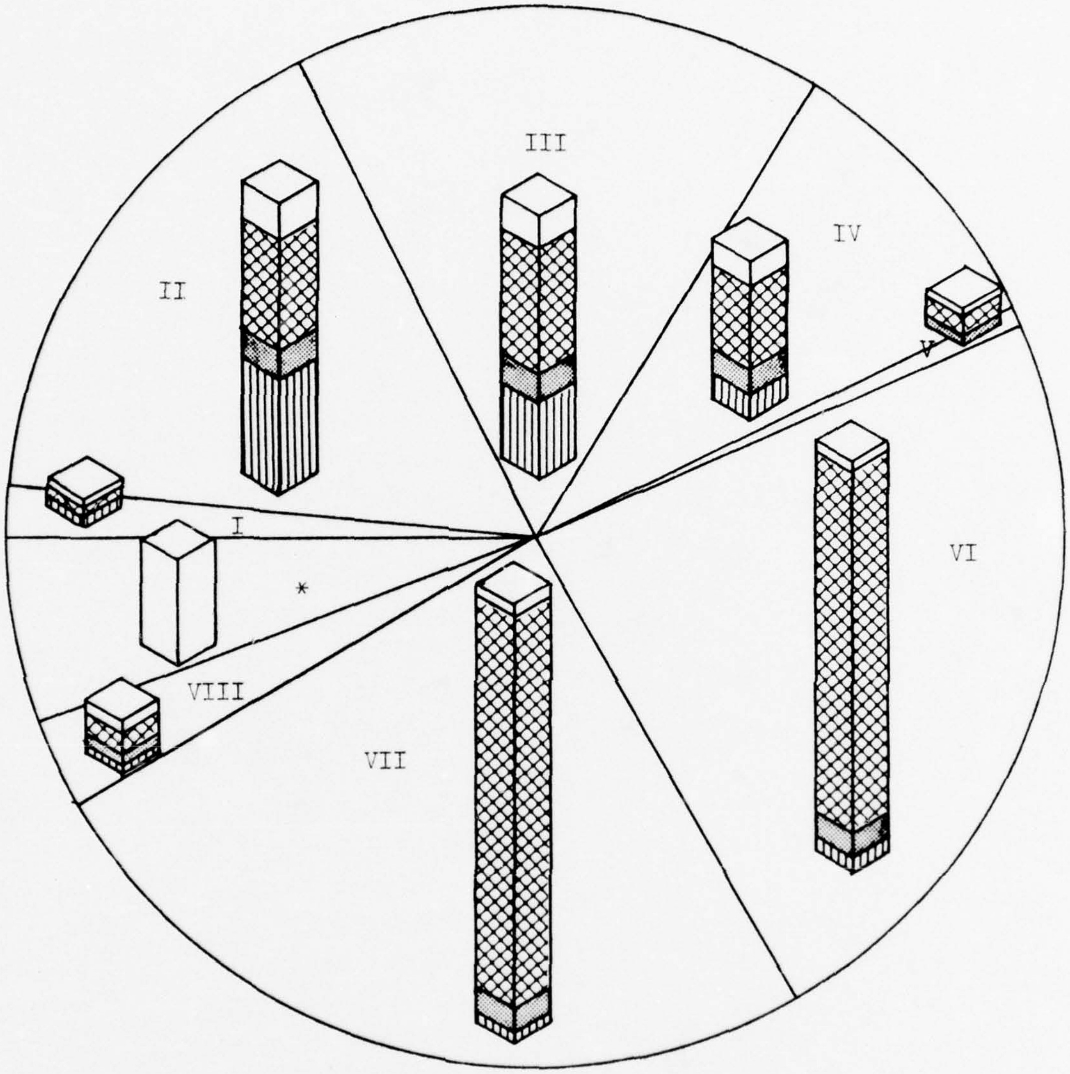
2/ Land and water areas were based on the drainage basins of the 21 hydrologic areas delineated for the North Atlantic Study. These were further grouped into six major subregions. Definitions of these 21 areas and six major subregions are shown in Figure G-1

3/ The portions of county urban and water acreage, both water bodies over and under 40 acres, were estimated in those counties which do not lie entirely within one drainage basin. Road maps and drainage maps were used to locate urban places and bodies of water.

Sources of Data: Land use with the exception of urban land was obtained from the Conservation Needs Inventory of 1958, conducted by the Soil Conservation Service with assistance from other agencies of the U. S. Department of Agriculture and various State agencies. Urban land and water areas over 40 acres were obtained from the "Area Measurement Reports" and the "Statistical Abstract" of the U. S. Department of Commerce. Water areas under 40 acres were obtained, also, from the Conservation Needs Inventory. The data were updated to reflect historical trends of the Census of Agriculture and the most recent data of the Forest Survey conducted by the Forest Service of the U. S. Department of Agriculture. Total areas for each basin were obtained from previously published reports.

Sheet 2 of 2

REGIONAL LAND USE WITHIN LAND CAPABILITY CLASS
NORTH ATLANTIC REGION



Land Capability Class	Acreage (1,000,000 Acres)	Percent
I	1.7	1.6
II	17.1	16.2
III	16.3	15.4
IV	9.7	9.1
V	.6	.6
VI	24.8	23.5
VII	26.5	25.0
VIII	3.0	2.8
* 1/	6.1	5.8

Land Use

- Urban & Other
- Forest
- Pasture
- Crop

Scale - 0.1" = 1%

1/ Area reported without a land capability class.

Figure G-6

While crops supporting the dairy enterprise are grown throughout the Region, general farming and specialized crops are more prevalent in the southern portion. Owing to the longer growing season the major portion of total cropland is found in the central and southern parts of the Region.

Steep slopes with shallow soils generally limit the use of land for crop and pasture. Fields are small and the size of farms is approximately one-half of the national average.

About 15 percent of the Region is in cropland. The wide variety of crops grown is influenced by the topography and climatic conditions. There are areas of general farming but for the most part specialized crops are grown. Figure G-7 shows the distribution of cropland and pasture throughout the Region.

Cropland has much greater importance in Subregions C, D, E, and F (Table G-13). While considerably less than 10 percent of Subregions A and B is used for cropland, one-fourth of Subregion E is devoted to agricultural crops. There is considerably more than double the amount of cropland in Subregion E than in Subregions A and B combined. Cropland acreage in the NAR is more than double any other use except forest. Area 18 in Subregion E has the largest percentage of cropland (34 percent) in comparison to all other areas.

Pasture. Pasture is classified as land in grass or other long term forage growth that is used primarily for grazing. Pasture includes all grazing land with the exception of pasture in crop rotation. It may include shade trees or scattered trees with less than 10 percent stocking, but the principal plant cover is such as to identify its use primarily as permanent grazing land.1/

About 6 percent of total land in the NAR is occupied by pasture which is utilized for grazing primarily for the dairy enterprise. The cool humid climate and seasonal distribution of rainfall is excellent for the production of grass. Pasture is found on the steep upland soils, especially the more stony and shallow soils which are not suited for cultivation.

The total pasture acreage in the NAR is less than half of the total cropland acreage. The ratio of cropland to pasture varies widely between Subregions. In Subregion D cropland exceeded pasture by 300 percent, but in Subregions C and F the proportion of the area utilized for pasture is nearly 67 percent of that in cropland. This is primarily due to a smaller area in cropland rather than a larger area in pasture. (Table G-13.) Eighty percent of all pasture in the NAR is in three Subregions, C, E, and F. (Table G-14.)

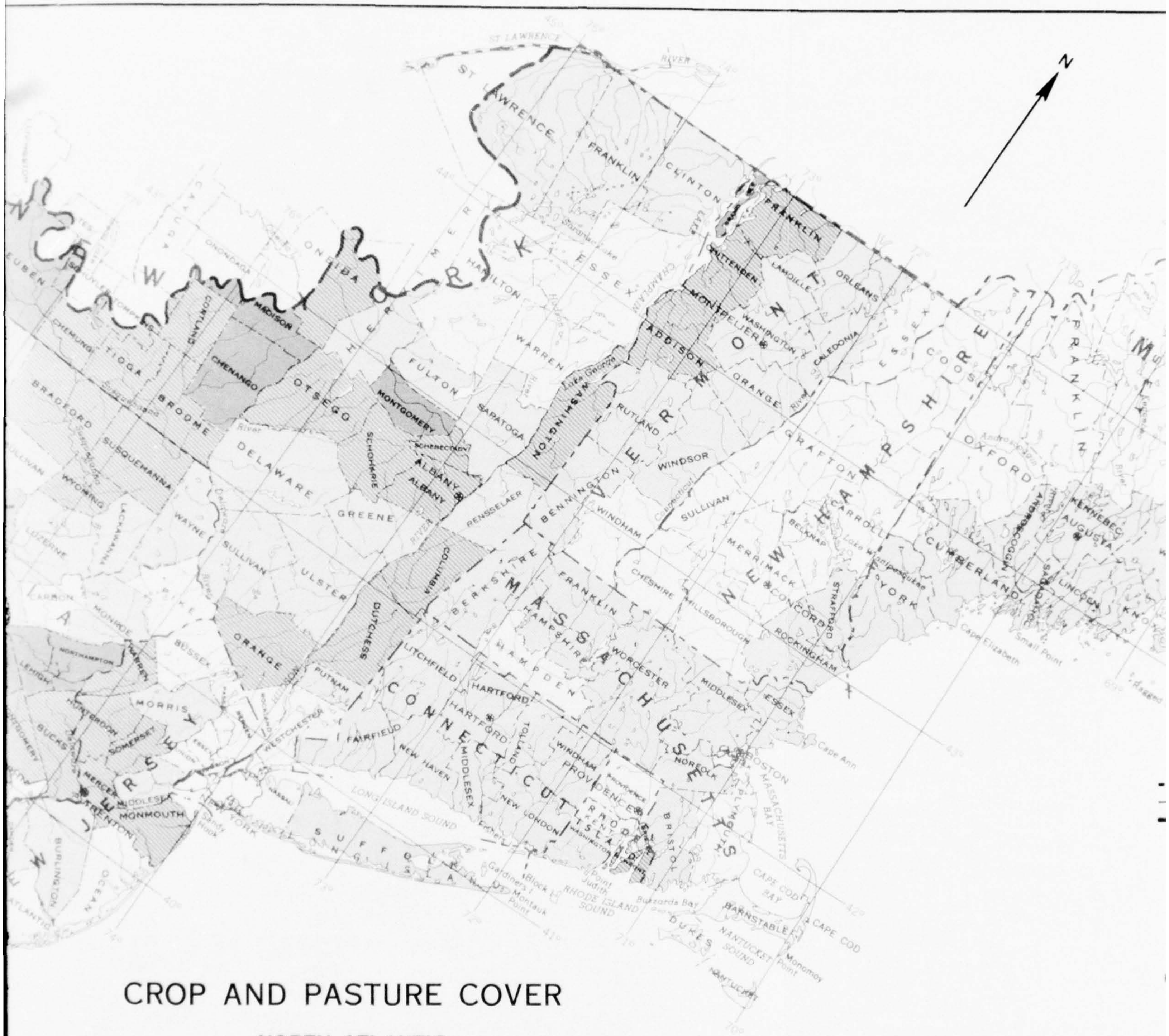
1/ This definition varies somewhat from the Census definition in that cropland pasture is separated in the Census. In this report it is included as pasture if it is used primarily for that purpose.

TABLE G-13

PERCENTAGE DISTRIBUTION OF LAND USE AND WATER AREAS
WITHIN SUBREGION AND AREA, 1963
NORTH ATLANTIC REGION

Subregion and Area	Cropland	Pasture	Forest	Other	Urban	Water Area Under: 40	Water Area Over 40	Total Land and Water
Subregion A								
1	5	-	90	1	1	-	3	100
2	4	1	85	1	2	-	7	100
3	8	2	82	1	2	-	5	100
4	6	1	83	2	4	-	4	100
5	6	-	75	3	3	-	13	100
AVERAGE A	5	1	84	2	2	-	6	100
Subregion B								
6	6	1	73	6	5	1	8	100
7	5	2	74	6	8	1	4	100
8	8	5	77	4	4	-	2	100
9	5	2	55	9	18	1	10	100
10	8	5	66	8	9	1	3	100
AVERAGE B	7	3	71	6	8	1	4	100
Subregion C								
11	16	12	58	6	2	-	6	100
12	15	8	61	8	5	-	3	100
13	5	-	30	7	45	-	13	100
AVERAGE C	15	9	58	7	6	-	5	100
Subregion D								
14	15	3	39	11	29	-	3	100
15	22	6	49	10	10	1	2	100
16	14	1	50	14	13	-	8	100
AVERAGE D	20	5	48	11	13	-	3	100
Subregion E								
17	23	8	56	7	5	-	1	100
18	34	4	33	14	4	1	10	100
AVERAGE E	25	7	51	9	5	-	3	100
Subregion F								
19	20	12	56	7	4	-	1	100
20	15	10	64	6	3	-	2	100
21	9	6	73	3	5	-	2	100
AVERAGE F	15	10	63	6	4	-	2	100
AVERAGE NAR	15	6	63	6	6	-	4	100

WEST VIRGINIA
VIRGINIA
MARYLAND
PENNSYLVANIA
DELAWARE
NEW JERSEY
STEUBEN
CHEMUNG
TIOGA
BRADFORD
SULLIVAN
WYOMING
LYCOMING
CLINTON
CAMERON
CLEARFIELD
BLAIR
CENTRE
HUNTINGDON
MIFFLIN
JUNIATA
SNYDER
COLUMBIA
LUZERNE
NORTHUMBERLAND
SCHUYLKILL
CARBON
BEDFORD
FULTON
FRANKLIN
CUMBERLAND
PERRY
DAUPHIN
LEBANON
HARRISBURG
BERKS
LEHIGH
NORTHAMPTON
ADAMS
YORK
LANCASTER
CHESTER
MONTGOMERY
BUCKS
PHILADELPHIA
DELAWARE
GARRETT
ALLEGANY
WASHINGTON
FREDERICK
CARROLL
BALTIMORE
HARFORD
HOWARD
MONTGOMERY
CECIL
KENT
QUEEN ANNES
TALBOT
CAROLINE
DORCHESTER
WICOMICO
SOMERSET
WORCESTER
SUSSEX
DOVER
SALEM
GLOUCESTER
CUMBERLAND
ATLANTIC
BURLINGTON
CAPE MAY
TRENTON
MINERAL
GRANT
HAMPSHIRE
MORGAN
BERKELEY
JEFFERSON
HARDY
PENDLETON
HIGHLAND
BATH
ALLEGHANY
CRAIG
BOTETOURT
ROCKBRIDGE
AUGUSTA
ROCKINGHAM
SHENANDOAH
PAGE
LOUDOUN
FAUQUIER
FAIRFAX
CULPEPER
MADISON
GREENE
ALBEMARLE
NELSON
AMHERST
ORANGE
LOUISA
BUCKINGHAM
CUMBERLAND
GOOCHLAND
HANOVER
CAROLINE
ESSEX
RICHMOND
CHARLES
ST. MARYS
CALVERT
ACCOMACK
NORTHAMPTON
NANSEMOND
Cape Charles
Cape Henry
Cape May
Cape Henlopen
CHESAPEAKE BAY
DELAWARE BAY
OCEAN



CROP AND PASTURE COVER

NORTH ATLANTIC
REGIONAL WATER RESOURCES STUDY

U. S. DEPARTMENT OF AGRICULTURE

October 1968

25 0 25 50 75 100 Miles

2

FIGURE G-7

USDA-SCS-HYATTSVILLE, MD. 1971

TABLE G-14

PERCENTAGE DISTRIBUTION OF LAND USE AND WATER AREAS
BY AREA, WITHIN THE REGION, 1963
NORTH ATLANTIC REGION

Subregion and Area	Cropland	Pasture	Forest	Other	Urban	Water Area Under: 40 Acres	Water Area Over 40 Acres	Total Land and Water
Subregion A								
1	2	-	6	-	1	2	3	4
2	1	1	7	1	1	4	9	5
3	2	1	4	-	2	1	4	3
4	1	1	3	1	1	3	2	2
5	1	-	4	2	2	2	12	4
TOTAL A	7	3	24	4	7	12	30	18
Subregion B								
6	1	1	3	2	3	3	5	2
7	1	1	3	3	4	4	3	3
8	4	5	8	4	4	8	3	6
9	1	1	2	4	8	6	7	3
10	1	2	3	4	4	6	2	3
TOTAL B	8	10	19	17	23	27	20	17
Subregion C								
11	8	14	6	7	2	9	10	7
12	8	10	7	10	6	8	5	8
13	-	-	1	1	9	-	4	1
TOTAL C	16	24	14	18	17	17	19	16
Subregion D								
14	2	1	1	3	7	2	1	1
15	11	7	6	12	13	10	4	7
16	1	-	1	3	3	-	2	1
TOTAL D	14	8	8	18	23	12	7	9
Subregion E								
17	25	22	15	17	13	16	3	16
18	11	3	2	10	4	6	13	5
TOTAL E	36	25	17	27	17	22	16	21
Subregion F								
19	11	17	8	9	6	5	3	9
20	4	5	3	3	2	2	2	4
21	4	8	7	3	5	3	3	6
TOTAL F	19	30	18	15	13	10	8	19
TOTAL NAR	100	100	100	100	100	100	100	100

Forest. Forest is land which is at least 10 percent stocked by forest trees of any size and capable of producing timber or other wood products or capable of exerting influence on the water regime; lands from which such trees have been removed to less than 10 percent stocking and which have not been developed for other use; and areas that have been planted to trees. Both public and private forest lands are included.

Forest land of the NAR is the largest single land use and occupies approximately 66 percent of the total land area. Forests occupy all physiographic positions within the Region and are the main cover type at higher elevations and on mountain tops. There are nine major forest types in the Region as follows:

Major Forest Types	Percent of Forest Land Area
Oak-Hickory	29
Maple-Beech-Birch	24
Spruce-Fir	17
White-Red-Jack Pine	9
Aspen-Gray Birch	7
Loblolly-Short Leaf Pine	6
Elm-Ash-Cottonwood	4
Oak-Pine	3
Oak-Gum-Cypress	1

The location and areal distribution of forest types is illustrated in Figure G-8. The distribution and percent of commercial forest land by counties is illustrated in Figure G-9.

Forest is the largest single land use in 19 of the 21 Areas. Area 18 has more cropland than forest. The New York City - Long Island Area is 45 percent urbanized and 30 percent of the total area is classified as forest land. Only a slightly greater percent is forested in the Chesapeake Bay Area. A much higher percentage of the New England area is devoted to forest than is true of other areas. The St. John River Basin in New England has a larger percentage of forest cover than any other area. Only three areas have less than 50 percent of the land surface in forest, those being the New York - Long Island Area, the Passaic - Raritan River Area, and the Chesapeake Bay Drainage Area of Maryland and Delaware.

Other Land. Other land is all land included in the inventory acreage and not classified as cropland, pasture, urban, or forest. Most of this land would be used for such purposes as farmsteads, farm lanes, wasteland including all farm land not fitting the other categories, service stations, rural nonfarm residences, country churches and school grounds, roads and highways, and tracts of any size of open, idle, rural nonfarm land.

Other land comprises 6.5 percent of the land area in the Region and represents land which is not classified as cropland, pasture, forest or urban. Other land is subdivided into two categories; Other farmland and other nonfarmland.


WEST VIRGINIA
PENNSYLVANIA
HIGHLAND
ROCKBRIDGE
BEDFORD
CAMPBELL
LOUISA
FAUQUIER
CLEARFIELD
CLINTON
BLAIR
BRADFORD
DOVER
DELAWARE
BAY
Cape May
Cape Henlopen
Cape Charles
Cape Henry
NANSEMOND

FOREST COV

WHITE-RED PINE: Forests in which 50 percent or more of the stand is eastern white pine or red pine, singly or in combination. (Common associates are hemlock, aspen, birch, and maple.)

SPRUCE-FIR: Forests in which 50 percent or more of the stand is spruce or true firs, singly or in combination. (Common associates are white-cedar, tamarack, maple, birch, and hemlock.)

LOBLOLLY-SHORTLEAF PINE: Forests in which 50 percent or more of the stand is loblolly pine, shortleaf pine, pitch pine, or Virginia pine. (Common associates are oak, hickory, and gum.)

OAK-PINE: Forests in which 50 percent or more of the stand is hardwoods, usually upland oaks, but in which southern pines make up 25-49 percent of the stand. (Common associates are gum, hickory, and yellow-poplar.)

OAK-HICKORY: Forests in which 50 percent or more of the stand is upland oaks or hickory, except where pines comprise 25-49 percent, in which case the stand is oak-pine. (Common associates are yellow-poplar, elm, maple, and black walnut.)

FOREST COVER TYPES

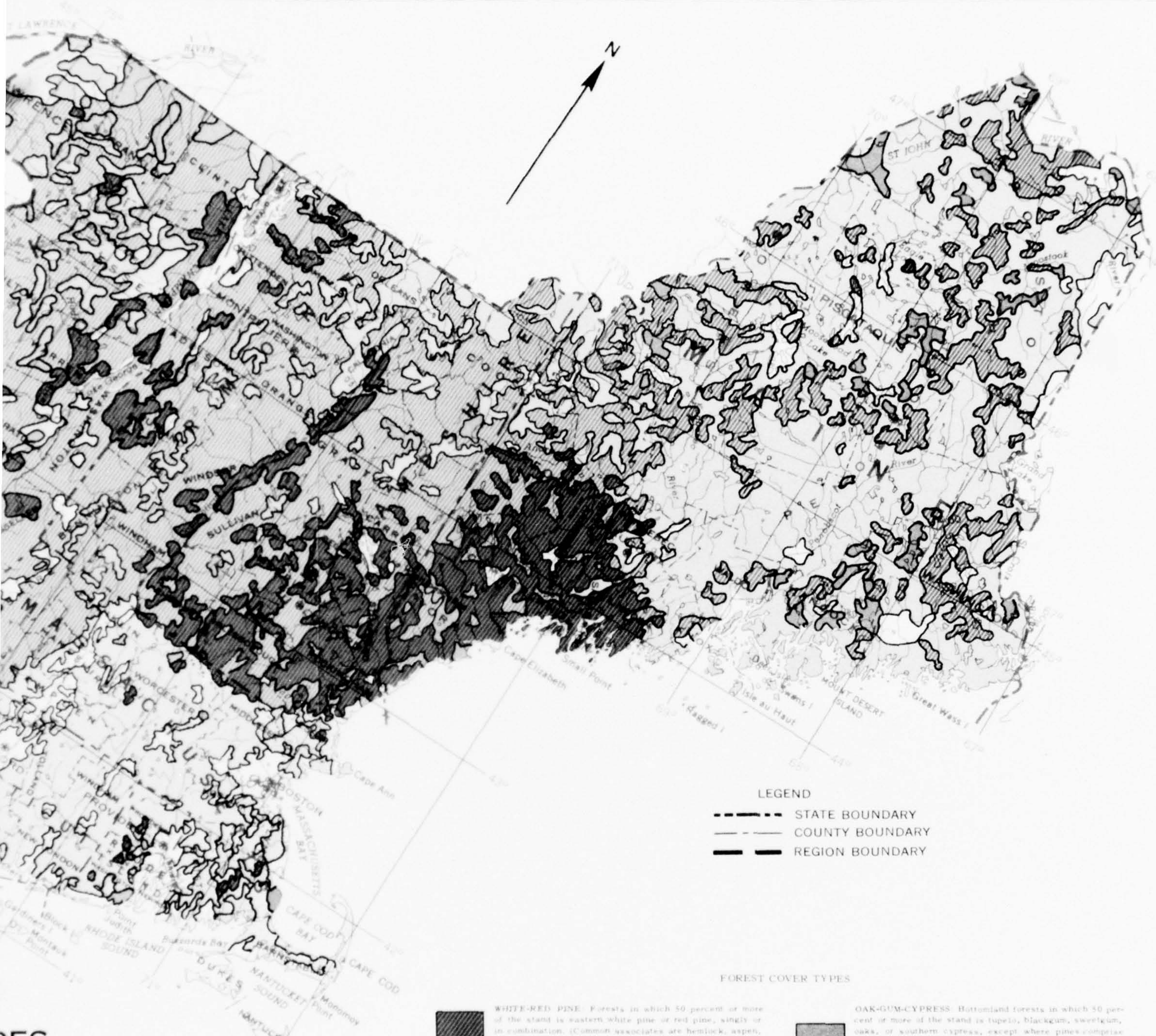
NORTH ATLANTIC
REGIONAL WATER RESOURCES STUDY

U. S. DEPARTMENT OF AGRICULTURE

October 1968

25 0 25 50 75 100 Miles

2



LEGEND

STATE BOUNDARY

COUNTY BOUNDARY

REGION BOUNDARY

PES

STUDY

100 Miles

FOREST COVER TYPES

WHITE-RED PINE: Forests in which 50 percent or more of the stand is eastern white pine or red pine, singly or in combination. (Common associates are hemlock, aspen, birch, and maple.)

SPRUCE-FIR: Forests in which 50 percent or more of the stand is spruce or true firs, singly or in combination. (Common associates are white-cedar, tamarack, maple, birch, and hemlock.)

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OAK-HICKORY: Forests in which 50 percent or more of the stand is upland oaks or hickory, except where pines comprise 25-49 percent, in which case the stand is oak-pine. (Common associates are yellow-poplar, elm, maple, and black walnut.)

OAK-GUM-CYPRESS: Bottomland forests in which 50 percent or more of the stand is tupelo, blackgum, sweetgum, oaks, or southern cypress, except where pines comprise 25-49 percent, in which case the stand is oak-pine. (Common associates are cottonwood, willow, ash, elm, hackberry, and maple.)

ELM-ASH-RED MAPLE-COTTONWOOD (swamp hardwoods): Forests in which 50 percent or more of the stand is elm, black ash, red maple, or cottonwood. (Common associates are willow, sycamore, beech, and other ash.)

MAPLE-BEECH-BIRCH: Forests in which 50 percent or more of the stand is maple, beech, or yellow birch. (Common associates are hemlock, elm, basswood, and white pine.)

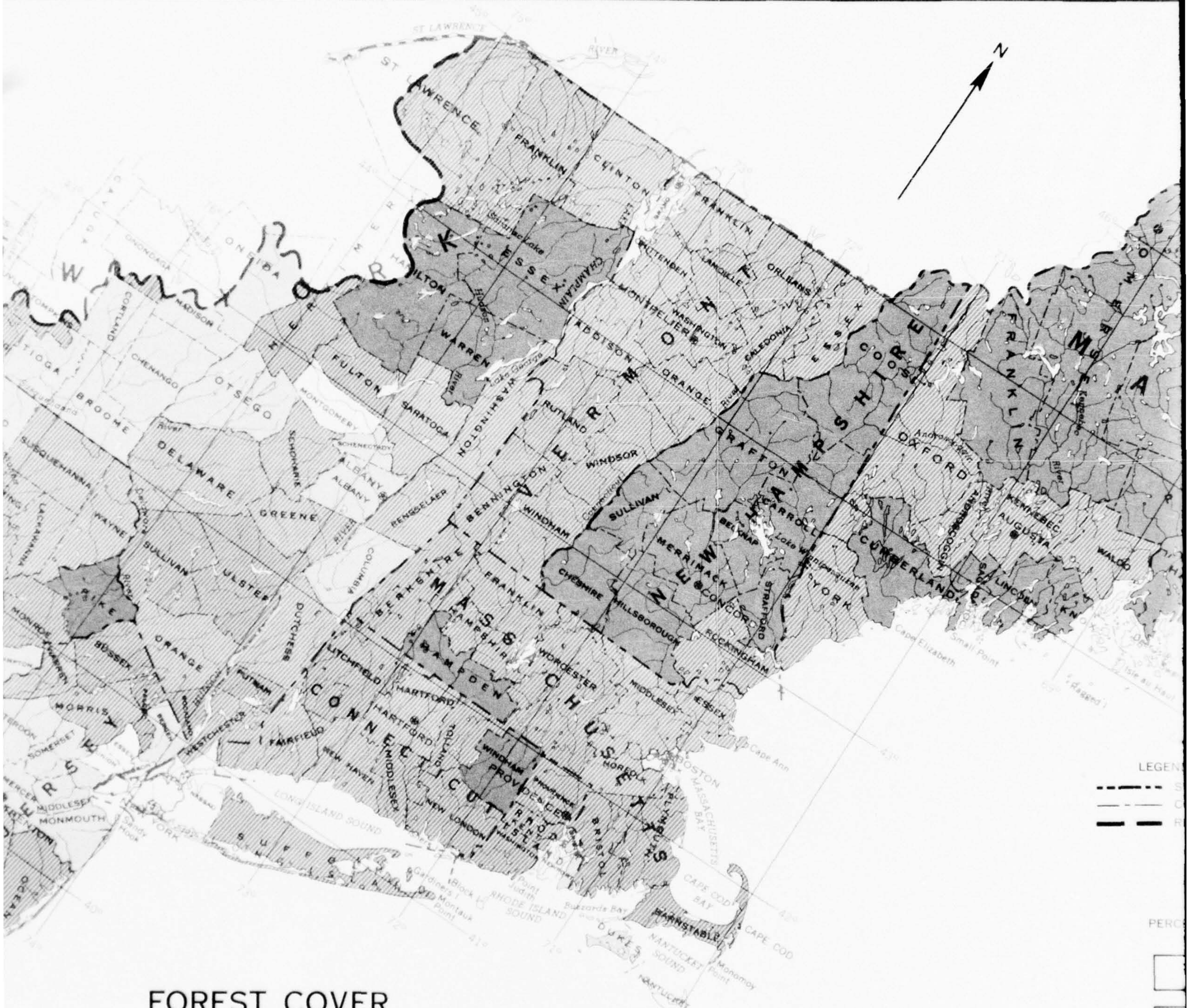
ASPEN-BIRCH: Forests in which 50 percent or more of the stand is aspen, balsam poplar, paper birch, or gray birch. (Common associates are maple and balsam fir.)

NONTYPED: Areas having less than 10 percent forest.

FIGURE G-8

USDA-SCS-HYATTSVILLE, MD. 1971

SOURCE: USDA Forest Service, Forest Survey Statistics



FOREST COVER

NORTH ATLANTIC
REGIONAL WATER RESOURCES STUDY

U. S. DEPARTMENT OF AGRICULTURE

October 1968

25 0 25 50 75 100 Miles

FIGURE G-9

USDA-SCS-HYATTSVILLE, MD. 1971

3

Stone Valley Watershed illustrates a mixture of good land uses.

Approximately 1.7 million acres are classified as Other land in farms. Included are farmsteads, farm lanes and idle or waste land. The primary use of idle Other land is for cover for wildlife and recreation.

There are 5.2 million acres of Other nonfarmland in the Region. Roads, highways and tracts of open idle rural nonfarmland lying adjacent to Urban areas comprise the major portion of the Other nonfarmland. The highest proportion of Other land is in Subregions D and E, 11 and 9 percent respectively. (Table G-13). This would be expected due to the large number of rural residences to be found in these areas and the interlacing of highways. The percent of area included as Other reached a high of 14 percent in Areas 16 and 18. By contrast in Subregion A only 2 percent of the area is in Other land and much of this is in Area 5, the Maine Coastal Area.

Urban. Urban refers to all places, incorporated or unincorporated, of 1,000 inhabitants. Less formally, urban places include suburban and exurban areas within the above definition. Arbitrary boundaries were established in unincorporated places for acre measurement purposes. This definition varies somewhat from the definition used in the CNI. Only 7 percent of the Urban land in the NAR is in Subregion A. Subregions B and D have the largest percentage of the total Urban land in the NAR with 23 percent each. On an individual basis the Delaware and Susquehanna River Basins contain the largest proportion of total Urban land, 13 and 14 percent respectively. (Table G-14)

Urban areas utilize 6 percent of all the land in the NAR. By national comparison Urban land use rates high in the Region. Urban land is used for residential, commercial and industrial purposes.

Urban development usually occurs on land with the highest capability class such as Class I and II and is somewhat scattered owing to expansion along major transportation corridors.

Some of the smaller coastal areas are highly urbanized. Eighteen percent of Area 9, the Rhode Island - Western Massachusetts area, is devoted to urban use. The combined Urban and Other land in this area is used for residential, commercial and industrial development and transportation facilities. Area 13, the New York-Long Island area, represents the highest percentage of Urban and Other development (52 percent) in the Region. Subregion D has the largest percentage of Urban land (13 percent) in the Region. The combined Urban and Other uses have a total of 24 percent. (Table G-13)

Water Surface Areas

Under 40 acres. This definition includes all bodies of water under 40 acres and streams less than one-eighth mile wide in the NAR. Subregion B has the highest percentage of water areas under 40 acres with 27 percent. Subregion F has the least with 10 percent. Water areas under 40 acres in size represent one percent

in six of the 21 Areas in the NAR, four of which are located in Subregion B. In the remaining areas less than one-half of one percent is in water bodies under 40 acres.

Over 40 acres. This definition includes permanent inland water surface, such as lakes, reservoirs and ponds having 40 acres or more of area; streams, sloughs, estuaries, and canals one-eighth of a statute mile or more in width; deeply indented embayments and sounds, and other coastal waters behind or sheltered by headlands or islands separated by less than one nautical mile of water and islands having less than 40 acres of area. It does not include water surface of the ocean, bays, the Great Lakes, or Long Island Sound.

Water areas over 40 acres account for 4 percent of the total land and water area of the NAR. Much of the water surface areas over 40 acres is located along the coast. One-half of this water area is in Subregions A and B. These areas are not only blessed with a long coastline but also with many large inland lakes. Unfortunately, many of the lakes are located in areas not easily accessible for human use or are so far north that their temperatures may limit their use for recreational purposes. Four different Areas, 5, 9, 13, and 18 have 10 percent or more of their total area in water surface over 40 acres. Each of these Areas is located along the coast. However, for some forms of recreation, coastal waters are as useful as the fresh water lakes. The 7 coastal areas account for 45 percent of the total water surface area over 40 acres of the NAR.

Subregion C accounts for 19 percent of the water surface areas larger than 40 acres. This is largely due to the inclusion of Lake Champlain in this Subregion. Subregions D and F account for a relatively small part of the total NAR water surface areas. Water surface acres are shown by areas and states in Tables G-11 and G-12.

COMPETITION FOR LAND USE

Population 1/

In 1960 the population of the NAR exceeded 44.6 million. By 2020 Regional population is expected to reach approximately 86.3 million. (Table G-15).

1/ Population data from 1940 to 1960 is taken from the U. S. Census of population. The U. S. Department of Commerce prepared projections for the target years. ERS projected the proportions of total population that will be rural farm and nonfarm by extrapolation of historic trends.

TABLE G-15
POPULATION BY SUBREGIONS, 1960
WITH PROJECTED YEARS TO 1980, 2000 and 2020
NORTH ATLANTIC REGION

Subregions	1960	1980	2000	2020
		(Thousands)		
A	687	763	872	1,021
B	9,551	11,787	14,790	18,397
C	13,054	15,472	18,127	21,351
D	11,124	14,078	18,037	22,571
E	5,372	6,670	8,347	10,359
F	4,866	6,873	9,439	12,562
TOTAL NAR	44,654	55,643	69,612	86,261

Table G-16 presents the population distribution in percentage over the six subregions for 1960 and the projected years. It is noted that F is the only Subregion that is expected to substantially increase its share of the Regional population. Subregion F had 10.9 percent of the total population in 1960, and is projected to have 14.6 percent in 2020. Subregions B, C and D contained more than 75 percent of the Region's population in 1960 while Subregion A had less than 2 percent.

TABLE G-16
REGIONAL DISTRIBUTION OF POPULATION BY SUBREGIONS, 1960
AND PROJECTED YEARS 1980, 2000 and 2020
NORTH ATLANTIC REGION

Subregions	1960	1980	2000	2020
		(percent)		
A	1.6	1.4	1.3	1.2
B	21.4	21.2	21.2	21.3
C	29.2	27.8	26.0	24.7
D	24.9	25.3	25.9	26.2
E	12.0	12.0	12.0	12.0
F	10.9	12.3	13.6	14.6
TOTAL NAR	100.0	100.0	100.0	100.0

Rural Population

Although increasing in absolute numbers, rural population has been experiencing a decline in the share of total population in recent years. See Table G-17. In 1940 more than 23 percent of the Region population was rural and by 1960 this had declined to approximately 19.3 percent. Total rural population in 1960 was 8.6 million and is projected to increase to 13.1 million in 2020.

TABLE G-17
RURAL-URBAN DISTRIBUTION OF POPULATION BY SUBREGIONS,
1940, 1950 and 1960 and projected years 1980, 2000 and 2020
NORTH ATLANTIC REGION

Subregions	1940	1950	1960	1980	2000	2020
			(Percent	Rural)		
A	66.5	55.1	53.9	49.0	46.0	44.0
B	19.2	20.3	20.4	22.0	22.7	23.0
C	13.0	10.2	10.2	9.0	9.0	9.0
D	19.8	15.8	13.9	10.0	8.0	7.1
E	41.4	36.7	37.3	33.0	31.5	30.5
F	45.2	34.8	29.2	24.5	21.0	18.5
NAR	23.3	20.2	19.3	17.2	16.0	15.2
			(Percent	Urban)		
A	33.5	44.9	46.1	51.0	54.0	56.0
B	80.8	79.7	79.6	78.0	77.3	77.0
C	87.0	89.8	89.8	91.0	91.0	91.0
D	80.2	84.2	86.1	90.0	92.0	92.9
E	58.6	63.3	62.7	67.0	68.5	69.5
F	54.8	65.2	70.8	75.5	79.0	81.5
NAR	76.7	79.8	80.7	82.8	84.0	84.8

Changes in the rural population are much more dramatic when the farm and nonfarm sectors are analyzed separately. Table G-18 presents farm and nonfarm population as a percent of total rural population. Farm population as a percent of rural (which is increasing absolutely) has declined sharply from 1940 to 1960. In 1940 farm population represented 30 percent of the people in rural areas. By 1960 it had dwindled to approximately 11 percent. This trend is expected to continue and by 2020 only 3 percent of the rural population will be on farms. Farm population will represent only about one-half of one percent of the total population in 2020. In contrast nonfarm population increased from 70 percent of rural in 1940 to 89 percent in 1960.

TABLE G-18
FARM-NONFARM DISTRIBUTION OF RURAL POPULATION,
BY SUBREGIONS, 1940, 1950 and 1960 and
PROJECTED YEARS 1980, 2000 and 2020
NORTH ATLANTIC REGION

Subregions	1940	1950	1960	1980	2000	2020
			(Percent Farm)			
A	35	29	11	7	4	3
B	22	14	5	2	1	1
C	24	21	11	6	3	2
D	22	19	9	8	5	3
E	35	29	15	8	5	4
F	49	35	17	9	5	3
NAR	30	24	11	6	4	3
			(Percent Nonfarm)			
A	65	71	89	93	96	97
B	78	86	95	98	99	99
C	76	79	89	94	97	98
D	78	81	91	92	95	97
E	65	71	85	92	95	96
F	51	65	83	91	95	97
NAR	70	76	89	94	96	97

Urban Population

By 1940 the NAR could have been classified as a highly urbanized Region as nearly 77 percent of its residents were considered to live in urban areas. (Table G-17.) By 1960 nearly 81 percent was urban. Subregion A was the only subregion with less than 62 percent of its population in urban areas in 1960 (46.1 percent). Urban concentrations are very high in Subregions C and D where 84 to 90 percent of the population lives in the city.

Population Density

The reason that emphasis is given to population in a land use study is simply that the basic factor affecting the demand for land is that of population numbers. This very important relationship between population numbers and land resources often is stated quantitatively in terms of the number of persons per square mile or population density. A look at population densities in a subregionalized area readily reveals any major differences in population distribution pattern. (Table G-19.)

TABLE G-19
POPULATION DENSITY, BY SUBREGIONS, 1960,
AND PROJECTED YEARS 1980, 2000 AND 2020
NORTH ATLANTIC REGION

Subregions	1960	1980	2000	2020
	(Total Density - Persons Per Square Mile)			
A	23.4	20.0	29.7	34.8
B	340.8	420.6	527.7	656.4
C	506.8	600.6	703.7	828.9
D	656.4	830.7	1064.3	1331.9
E	155.9	193.5	242.2	300.6
F	158.6	224.1	307.7	409.5
NAR	264.0	333.9	421.4	522.1
	(Rural Area Density - Persons Per Square Mile)			
A	12.6	9.8	13.9	15.3
B	69.5	92.5	119.8	151.0
C	51.7	54.1	63.3	74.6
D	91.2	83.1	85.1	94.6
E	58.1	63.9	76.3	91.7
F	46.3	54.9	64.6	75.8
NAR	52.2	57.4	67.4	79.4

With a 1960 population density of 270 persons per square mile, the NAR is the most heavily urbanized region in the nation. The geographical distribution of population, however, is far from even. Along its northeast-southwest axis, a series of metropolitan areas radiate out from a dozen central cities whose population densities exceed 10,000 persons per square mile. These include Washington, Baltimore, Philadelphia, Newark, New York City, Providence and Boston.

These largest central cities and their adjacent suburban counties- bound together by a web of air, rail and highway routes and facilities - accounted for 61.9 percent of the NAR's total population of 44,653,000. A broad metropolitan band has been delineated and measured by demographers, geographers, planners and transportation specialists. This band, defined on the basis of county density measurements, includes densely developed urban nodes as well as interstititial and peripheral open areas lying in the path of future growth. Gottmann, in his study, Megalopolis (6) established its area as 53,575 square miles. In another study, the Regional Plan Association (2) placed its size at 67,690 square miles, and Jerome Pickard (7) assigned it an area of 51,000 square miles. If the most constrictive definition is accepted, this metropolitan band represented 30 percent of the NAR's total land area, or 40 percent of the total NAR area under the most liberal definition. Despite this relatively wide range in its reputed areal extent, most studies agreed that its 1960 population was between 36 and 39 million persons, or about 81 to 86 percent of the total 1960 population of the NAR. Hence, this seaboard belt of urbanizing counties, cities and metropolitan areas represents the living environment of the overwhelming proportion of the NAR's population.

Equally impressive is the fact that in 1960 the five core cities in this band, exclusive of their suburbs, contained over 13 million persons or almost 30 percent of the total NAR population. This, of course, is made possible by densities that range from 24,500 persons per square mile in New York City to 11,900 persons per square mile in the city of Baltimore. Washington, D.C. with 12,400 persons per square mile, Boston with 14,600 persons per square mile, and Philadelphia's 15,700 persons per square mile are intermediate in density within this group of the largest central cities of the NAR. High population densities in combination with high concentrations of employment and a great intensity of activities are characteristic features of urban life within this seaboard belt of cities.

Around the central cities are the older suburban areas, often located along commuter rail lines. These suburban areas range in population density from 1,000 to 10,000 persons per square mile. According to estimates, smaller cities and suburbs in this density category covered 4,700 square miles and housed 14.6 million people. This compares to the 15.4 million people on 790 square miles 1/ who were accounted for in cities with population densities of over 10,000 persons per square mile.

A less dense exurban belt characterized by a town/farm landscape pattern extends north from around Fredericksburg, Virginia, to the southern border of Maine. This exurban area is composed of municipalities with population densities of 100 to 1,000 persons per square mile. In 1960 it was estimated that 6.7 million people lived in the town/farm landscape of exurbia. What happens in this exurban area will largely determine the shape of the region in the next 50 years. Because of relatively low land costs and ease of land assembly these outer suburban and exurban areas offer the least cost, high amenity locations for new housing and industrial development.

Few, if any, natural features offer serious constraints to development between the Appalachian Mountain ridges and hills, amd the Atlantic margin. The existence of river flood plain or marshland are local in extent and when development pressures have been intense, even these obstacles have been either overcome through engineering devices or simply ignored, sometimes at some peril to hapless homeowners. Despite the fact that the NAR is the most highly urbanized region in the nation, less than 6 percent of its total land area is developed in concentrated urban uses. Given the absence of major physical development constraints, particularly along its coastal plains and river valleys, it is clear that the future "shape" of urban settlement will be determined by man-made decisions rather than by any imperatives of the physical environment.

1/ These RPA estimates exclude Richmond, Virginia.

Although the five largest metropolises dominate the NAR, the region's settlement pattern is characterized by a wide range of cities varying in size and density. The Regional Plan Association has established five urban subregional classes within the NAR based on the 1960 population size and gross density of the central city. These classes are as follows:

Class 1 Subregions	- Populations over 250,000 and gross densities greater than 10,000 persons per square mile.
Class 2 Subregions	- Populations of 150,000 to 250,000; density of 5,000 to 10,000 persons per square mile.
Class 3 Subregions	- Populations of 75,000 to 150,000; density of 5,000 to 10,000 persons per square mile.
Class 4 and 5 Subregions	- Under 75,000 in population; density under 5,000 persons per square mile. (Distinction between Subregion Class 4 and 5 is based on considerations of economic base or other nondemographic factor.)

These definitions were applied to the central city population and gross density figures shown in Table G-20 resulting in the distribution of subregions given in Table G-21. 1/

Diversity of People

The constituency of the NAR is exceedingly diverse. Local customs and traditions vary widely, from Old South to Maine Downeaster, with Border South, New England Yankee and Mountain Appalachian in between. Ethnic, occupational and social subcultural diversity is compounded by the administrative patchwork of local government. Such a large concentration of people could hardly be expected to share a common set of aspirations or values, or a common view of what constitutes the best kind of living environment. Despite the high degree of urbanization, it can reasonably be assumed that for most people questions regarding the form or structure of future metropolitan growth eludes them completely.

1/ A total of 55 urban-subregions were delineated by RPA within the 23 Water Resource Planning Areas established by the Office of Business Economics.

TABLE G-20

POPULATION AND GROSS POPULATION DENSITY, 1960
OF THE CENTRAL CITIES IN EACH SUBREGION

NORTH ATLANTIC REGION

Region and Subregion	Central City	1960 Population (000's)	1960 Gross Population Density (000's/ sq.mile)
2. Portland, Me.			
1. Portland	Portland, Me.	72.6	3.4
3. Manchester, N.H.			
2. Portsmouth	Portsmouth, N.H.	26.9	1.7
3. Concord	Concord N.H.	29.0	0.5
	Manchester, N.H.	88.3	2.8
4. Laconia	Laconia, N.H.	15.3	0.8
4. Upper Connecticut River Valley			
5. Berlin	Berlin, N.H.	17.8	2.4
6. Claremont	Claremont, N.H.	13.6	0.3
7. Brattleboro	Brattleboro, Vt.	9.3	1.6
8. Caledonia*	--	--	--
5. Burlington-Rutland			
9. Burlington	Burlington, Vt.	35.5	2.2
10. Addison	Rutland, Vt.	18.3	2.4
	Bennington, Vt.	8.0	2.2
11. Montpelier	Montpelier, Vt.	8.8	1.0
6. Boston			
12. Barnstable*	--	--	--
13. Boston	Boston, Mass.	697.2	14.6
14. Worcester	Worcester, Mass.	186.6	5.0
15. Rhode Island	Providence, R.I.	207.5	9.2
7. Hartford-Springfield			
16. New Haven	New Haven, Conn.	152.0	8.5
	Bridgeport, Conn.	156.7	8.8
	Waterbury, Conn.	107.1	3.9
17. Hartford	Hartford, Conn.	162.2	9.3
18. New London	New London, Conn.	34.2	5.6
19. Springfield	Springfield, Mass.	174.5	5.3
	Pittsfield, Mass.	57.9	1.4
9. Albany-Troy-Schenectady			
20. Albany	Albany, N.Y.	129.7	6.8
	Troy, N.Y.	67.5	7.3
	Schenectady, N.Y.	81.7	7.9
10. Syracuse-Utica			
21. Watertown	Watertown, N.Y.	33.3	3.8
22. Syracuse	Syracuse, N.Y.	216.0	8.6
23. Utica	Utica, N.Y.	100.4	5.9
	Rome, N.Y.	51.6	0.7
12. Binghamton-Elmira			
24. Elmira	Elmira, N.Y.	46.5	6.6
25. Binghamton	Binghamton, N.Y.	75.9	7.0
13. Allentown-Bethlehem			
26. Ulster*	--	--	--
27. Warren	Phillipsburg, N.J.	18.5	5.6
28. Reading	Reading, Pa.	98.2	10.2
29. Allentown	Allentown, Pa.	108.3	6.2
	Bethlehem, Pa.	75.4	4.0
	Easton, Pa.	32.0	8.6
14. New York City			
30. New York	New York, N.Y.	7782.0	24.5
	Newark, N.J.	405.2	17.2
15. Williamsport, Pa.			
31. Du Bois	Du Bois, Pa.	10.7	3.3
32. Williamsport	Williamsport, Pa.	42.0	5.1
16 York-Lancaster-Harrisburg			
33. Altoona	Altoona, Pa.	69.4	7.7
34. Snyder*	--	--	--
35. Harrisburg	Harrisburg, Pa.	79.7	10.5
	York, Pa.	54.5	11.6
	Lancaster, Pa.	61.1	8.4
36. Wilkes-Barre	Wilkes-Barre, Pa.	63.6	9.2
37. Scranton	Scranton, Pa.	111.4	4.4
17. Philadelphia			
38. Philadelphia	Philadelphia, Pa.	2002.5	15.7
	Camden, N.J.	117.2	13.5
39. Wilmington	Wilmington, Del.	95.8	6.1
40. Trenton	Trenton, N.J.	114.2	15.4
41. East Jersey	Atlantic City, N.J.	59.5	5.2
42. Kent (Del.)*	--	--	--
18. Baltimore			
43. Baltimore City	Baltimore, Md.	939.0	11.9
44. Salisbury	Salisbury, Md.	16.3	4.2
19. Washington, D.C.			
45. Washington	Washington, D.C.	764.0	12.4
	Arlington, Va.	163.4	6.8
	Alexandria, Va.	91.0	6.1
46. Hagerstown	Hagerstown, Md.	36.7	5.1
47. Cumberland	Cumberland, Md.	33.4	3.7
48. Hardy*	--	--	--
20. Staunton-Winchester			
49. Staunton	Staunton, Va.	22.2	2.5
50. Harrisonburg	Harrisonburg, Va.	11.9	4.0
51. Winchester	Winchester, Va.	15.1	5.0
22. Richmond			
52. Richmond	Richmond, Va.	220.0	5.9
	Hopewell, Va.	17.9	2.6
	Colonial Heights, Va.	9.6	1.2
	Petersburg, Va.	36.8	4.6
53. Charlottesville	Charlottesville, Va.	29.4	4.9
23. Norfolk			
54. Norfolk	Norfolk, Va.	304.9	6.1
	South Norfolk, Va.	22.0	3.1
	Portsmouth, Va.	144.8	8.0
	Newport News, Va.	113.7	1.5
55. Accomack*	--	--	--

*Subregion contains no central city.

Source: Regional Plan Association, Study of Present and Projected Urban Development and Land Use in North Atlantic Region (Preliminary Issue), Table 1, p. 5.

TABLE G-21

SUBREGIONS BY CLASS OF CENTRAL CITY
NORTH ATLANTIC REGION

Class 1

Subregion	Central City
30	New York, N.Y.
30	Newark, N.J.
38	Philadelphia, Pa.
38	Camden, N.J.
43	Baltimore, Md.
13	Boston, Mass.
45	Washington, D.C.
45	Arlington, Va.
45	Alexandria, Va.

Class 2

Subregion	Central City
20	Albany, N.Y.
20	Troy, N.Y.
20	Schenectady, N.Y.
1	Portland, Me.
39	Wilmington, Del.
15	Providence, R.I.
16	New Haven, Conn.
16	Bridgeport, Conn.
16	Waterbury, Conn.
17	Hartford, Conn.
19	Springfield, Mass.
19	Pittsfield, Mass.
35	Harrisburg, Pa.
35	York, Pa.
35	Lancaster, Pa.
22	Syracuse, N.Y.
52	Richmond, Va.
52	Hopewell, Va.
52	Colonial Heights, Va.
52	Petersburg, Va.
40	Trenton, N.J.
29	Allentown, Pa.
29	Bethlehem, Pa.
29	Easton, Pa.

Class 3

Subregion	Central City
54	Norfolk, Va.
54	South Norfolk, Va.
54	Portsmouth, Va.
54	Newport News, Va.
28	Reading, Pa.
36	Wilkes-Barre, Pa.
37	Scranton, Pa.
33	Altoona, Pa.
14	Worcester, Mass.
41	Atlantic City, N.J.
23	Utica, N.Y.
23	Rome, N.Y.
25	Binghampton, N.Y.

Class 4

Subregion	Central City
10	Rutland Vt.
10	Bennington, Vt.
11	Montpelier, Vt.
7	Brattleboro, Vt.
24	Elmira, N.Y.
49	Staunton, Va.
50	Harrisonburg, Va.
51	Winchester, Va.
9	Burlington, Vt.
18	New London, Conn.
32	Williamsport, Pa.
21	Watertown, N.Y.
44	Salisbury, Md.
46	Hagerstown, Md.
53	Charlottesville, Va.
48	Hardy County, W.Va.
47	Cumberland, Md.
4	Laconia, N.H.
5	Berlin, N.H.
6	Claremont, N.H.
3	Concord, N.H.
3	Manchester, N.H.
2	Portsmouth, N.H.

Class 5

Subregion	Central City
55	Accomack County, Va.
12	Barnstable County, Mass.
26	Ulster County, N.Y.
27	Phillipsburg, N.J.
42	Kent County, Del.
31	Du Bois, Pa.
34	Snyder County, Pa.
8	Caledonia County, Vt.

Source: Regional Plan Association, Study of Present and Projected Urban Development and Land Use in North Atlantic Region (Preliminary Issue), Table 2, p. 8.

The people within the NAR have been highly mobile in moving from farm to city making fundamental changes in their "way of life", as well as in making frequent "life-style" moves, from city to suburb and from suburb to suburb. In the future, fewer of the region's population increment will be from rural backgrounds. By the year 2000 most of the NAR's population will be several generations removed from farm life or direct contact with the land. Nevertheless, ownership of land, in one form or another, will continue to be an important value to large numbers of people. The extent to which this value can be satisfied by cooperative or condominium ownership is problematic. Judging from past and continuing trends, higher income and upward mobility is generally associated with outward mobility from center to suburb and the change in status from renter to owner.

Another characteristic shared by large numbers of the NAR's population is a growing consumer consciousness, not only with respect to material goods but to the environment as well. There is a growing recognition that certain products - clean air, high quality water and open space - cannot be purchased in the market, but must follow from political action. Concern with environmental problems is unlikely to diminish in strength, and resource development programs should both advance and take advantage of this consciousness to promulgate broad and imaginative programs that offer qualitative advances in environmental enhancement.

Concern with the elimination of poverty, and for equality of opportunity, is another important consideration to large numbers of people within the NAR. Generally more concerned with opportunity for economic advancement than with environmental issues, the antipoverty, equal opportunity movement may gradually change as minority group entry is achieved into the middle class and barriers to locational choice in housing are lowered. Nevertheless, water-related programs with demonstrable significance for urban recreation would undoubtedly gain support among the antipoverty, equal opportunity coalition and their political spokesmen.

The public investment decisions most likely to win the widest approval are those that help to extend material progress and equalize wealth on the one hand and promote high environmental quality on the other. Combining water resource development programs with urban open space reservation, the recapture of derelict waterfronts for public use and recreation, as well as possible new town development, may be the key to obtaining broad-based urban support for basin-wide land and water resource programs.

OBE Economic and Population Projections for the NAR

In 1964 the U.S. Department of Commerce, Office of Business Economics, and the USDA, ERS, undertook a national economic base study for the Water Resources Council. The objective was to establish area economic projections for given target periods to the year 2020. The major purpose of the projections was to aid

in estimating future land and water needs. Hence, they provide a valuable basis for hypothesizing and evaluating the development options for urban growth. The general procedure used by OBE in the study may be found in Appendix B.

In absolute terms the NAR is a dominant force in the nation's economy. With only 5 percent of the U. S. land area, it contained 25 percent of the nation's 1960 population and approximately the same proportion of jobs. Per capita income was 14 percent above the national average, and residents of the region received 30 percent of the total personal income generated in the U.S.

Economic growth in the NAR has been expanding at a decreasing rate relative to the nation. This slower rate of growth is projected to continue to 2020. However, as other regions approach the NAR in terms of industry mix, their rates will begin to approach the NAR's, hence, reducing regional differentiation in growth rates.

Employment in the NAR is weighted in the direction of trade, services and manufacturing. It is far below the U.S. average in the proportion of workers employed in agriculture and extractive industries. Employment in these latter industries is expected to decline at a one-third faster rate within the NAR than within the nation as a whole. In addition, manufacturing is projected to increase at a rate of less than 50 percent of the national average. Of the five heavy water-using industries (food and kindred products, chemicals and allied products, paper and allied products, petroleum refining, and primary metals) none is expected to grow at faster rates than the U.S. average.

Within the NAR OBE projections indicate there will tend to be a leveling of personal income toward the U.S. average. Areas with per capita incomes higher than the U.S. will tend to move toward the average with the reverse being true of low average per capita income areas. The listing below ranks WRPAs by their 1970 average per capita income relative to the U.S. (U.S. equals 1.00.)

No.	WRPA	1970	2020
21	Roanoke-Lynchburg	.79	.85
20	Staunton-Winchester	.78	.86
1	Bangor	.73	.79
5	Burlington-Rutland	.81	.85
15	Williamsport	.81	.94
8	Plattsburgh	.83	.98
4	Upper Connecticut River Valley	.86	.97
16	York-Lancaster-Harrisburg	.88	.93
2	Portland	.88	.94
22	Richmond	.91	.92
12	Burlington-Elmira	.92	.97

No.	WRPA	1970	2020
10	Syracuse-Utica	.96	.98
23	Norfolk	.96	1.00
13	Allentown-Bethlehem	.97	1.00
9	Albany-Troy-Schenectady	1.01	1.00
3	Manchester	1.01	1.00
11	Rochester-Genesee	1.07	1.01
18	Baltimore	1.09	1.04
6	Boston	1.09	1.04
17	Philadelphia	1.12	1.03
7	Hartford-Springfield	1.17	1.05
14	New York City	1.20	1.15
19	Washington, D.C.	1.28	1.13

The five WRPA's projected to have average per capita incomes greater than the U.S. average include Baltimore, Boston, Philadelphia, New York City and Washington-Potomac. It is projected that these five WRPA's will have a total 2020 population of 60,857,000 or slightly more than 70 percent of the total NAR population of 86,160,200. In all likelihood it is in these high income, high population areas that urban problems will be most acute and the bulk of public resources will have to be committed for housing, transportation, education and environmental pollution abatement and control.

Analysis of Urban Economic and Population Projections 1/

For purposes of long-term analysis, the AUR can be divided into three strips or belts based on differences in existing gross population densities. The major coastal belt, which contained over three-quarters of the region's 1960 population, had an average gross density of 714 persons per square mile. It is within the principal cities of this belt that the shift from blue-collar factory work to white-collar office employment has been most marked.

The next belt inland from the coast has a gross density averaging 135 persons per square mile. Its cities and metropolitan areas are a good deal smaller in size than those of the coastal belt. They are further distinguished from the latter by the relatively greater importance of manufacturing in their economic base and by the greater proportion of land in forest, parks and agriculture. The outlying belt contains the lowest population densities, with fewer and far smaller metropolitan areas and central cities. This belt has a high proportion of its total land area either in open space or devoted to agriculture and mining.

1/ Using the OBE employment and population projections, the RPA prepared an analysis of the probable distribution of economic activity by geographic belt within the AUR. The material in this section has been edited and abridged from the RPA report, Study of Present and Projected Urban Development and Land Use in North Atlantic Region.

Employment in the AUR is expected to grow at a rate commensurate with population but with a continuing shift in composition - fewer production jobs in the manufacturing sector and more white collar and service jobs of the kind whose typical habitat is the office building.

How will this growth affect the AUR? At the present time, it is estimated that less than one-tenth of the AUR's land area is urbanized. This portion is expected to increase. The questions are how and where?

One likely future pattern is a continuation of decentralization with widening suburbanization around the established central cities within each belt. In line with this assumption, the OBE projection is that the coastal belt will increase its share of the AUR's overall population from 78 to 79 percent of the total. This represents a slowing down of the 1940-1960 trend which saw the coastal belt's share increase from 75 to 78 percent of the total.

The two remaining belts of development are forecast to experience a continued decline in their respective population shares although, in both instances, this is expected to be at a slower rate than that which took place between 1940 and 1960. In absolute terms, however, each belt would realize substantial absolute gains with the two outer ones increasing their combined populations by 8 million, an amount which is very close to their existing total.

New population growth in each belt will most likely be located in the expanding suburban fringes within the established metropolitan areas. A considerable effort should be made, however, to develop residential communities within these areas at densities that are a good deal higher than those which characterize present new suburban development. The achievement of a more intensive development of suburban areas in the forecast period may depend upon the location of employment, particularly in the fast-growing office sector.

The distribution of new employment growth among the belts is expected to follow the pattern of population change. However, manufacturing activity is expected to grow more rapidly in the middle and outer developmental belts. This pattern follows the long-term shift in the location of manufacturing activity, reflecting the need for greater amounts of space (at the right price) and a continued elaboration of the highway network, alongside decreasing dependence on the railroad network which is so important in the coastal belt's transportation system. Indeed, it would be very difficult for the coastal belt to be able to match fully the competitive advantage enjoyed by the middle and outer belts of the AUR as locations for manufacturing activities.

Over the very long run, the continued ability of the coastal belt's principal central cities to absorb additional growth in office and related activities is related primarily to the capacities of the transportation systems servicing their old downtowns. Since virtually all new population may be expected, under present trends, to be located in noncentral city areas, this obviously implies a spreading out of the metropolitan area. This will take the form of expansion in the extent of presently constituted suburban and exurban areas. If the central cities office function is to be in a position to tap the labor markets present in these expanding suburban areas, one of the key requirements will be an efficient transportation system linking the two areas.

In view of the new office growth expected, however, it will inevitably be necessary for a great amount of it to be located outside the central cities altogether. If new office activities located outside of the existing central cities and their downtowns are to function in a reasonably effective manner - both for themselves as well as for other kinds of activities in the region - they will probably need to be grouped in relatively compact areas. While these areas need not be as intensively developed as those in the old downtowns, the extent of compactness required of them will probably necessitate that they be served by some form of public transportation.

What are the long-run implications of these trends for intrametropolitan area residential location patterns in each of the belts? It is quite clear that there will continue to be an outward spread of the effective metropolitan area boundary lines, assuming that central city (gross) densities have gone about as high as they are likely to go. This spreading out process will lead to a further blurring of the legibility of individual areas as they increasingly come together at their outer limits. This tendency is likely to be especially pronounced in the coastal belt.

Inside the individual metropolitan areas, the creation of new office centers - or the more intensive redevelopment of existing but still embryonic centers - largely in the presently settled suburban areas will call for a change in the composition of the housing stock in these areas. At the present time, they still consist mainly of single family units. The residential areas surrounding the projected centers will have to provide a good deal more multi-unit structures than is presently the case. This increase in the number of apartment houses in areas that are now predominantly single family will not arise primarily because of income considerations; over the very long run, very few households will not be in a position to exercise real choice between single family housing and multi-family housing. The problem rather will be one of increasing the amount of choice needed to accommodate people with different needs who will be employed in these new centers. In the medium run, there will also be a problem of

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providing low-cost housing in suburban areas either in the form of multi-family units or in single family developments.

In regard to the housing implications of the dispersal of manufacturing from the central cities to the outer parts of the metropolitan area, somewhat similar conclusions emerge with respect to appropriate long and medium run policies. In the medium run, the implications for housing policy of manufacturing dispersal are clear: more low cost housing out in the suburbs. Given the dispersed character of new manufacturing locations in the suburbs - even assuming a liberal use of such concentrating forms as industrial parks - low cost housing will have to be arranged in low density settlement patterns as well. In the long run, when the great majority of factory workers do in fact enjoy middle income status, the appropriate housing needed to fit in with dispersed industrial patterns will probably continue to reflect low density arrangements.

The great expanse of urbanized areas consists of single family structures with streets providing the only form of public open space; forest and farmland give way to new residential areas of uniform physical design and social characteristics.

TABLE G-22

PAST AND PROJECTED POPULATION OF MAJOR BELTS OF DEVELOPMENT AND THEIR COMPONENT WATER RESOURCES PLANNING AREAS, 1940-2020
NORTH ATLANTIC REGION

Water Resources Planning Areas	1940	1960	1980	2000	2020
			(in thousands)		
Coastal Belt	26229	35323	45337	56037	69591
Boston	4454	5278	6422	7942	9717
Hartford	2286	3265	4156	5330	6740
New York	12099	15485	18905	22925	27533
Philadelphia	3996	5587	7153	9183	11603
Baltimore	1344	1999	2503	3088	3783
Washington	1561	2747	4140	5978	8221
Norfolk	489	962	1258	1591	1994
Middle Belt	5896	6820	8210	10127	12465
Manchester	347	450	581	774	1021
Albany-Troy	816	964	1089	1317	1578
Syracuse	884	1130	1374	1704	2116
Allentown	1157	1310	1502	1721	2001
York-Lancaster	2063	2137	2609	3273	4071
Richmond	629	829	1055	1338	1678
Outer Belt	2764	3187	3801	4652	5697
Portland	521	602	681	790	927
Upper Connecticut Valley	258	274	303	350	404
Burlington-Rutland	246	273	320	392	477
Binghamton	702	849	1046	1307	1640
Williamsport	396	431	491	595	715
Staunton-Winchester	189	233	314	418	546
Roanoke	452	525	646	800	988
North Atlantic Urban Region Areas	34889	45330	56548	70816	87753
United States Excluding Overseas	132165	179323	234193	306757	397562

Source: Regional Plan Association, Study of Present and Projected Urban Development and Land Use in North Atlantic Region (Preliminary Issue), part 2, Table A-1, p. 18.

TABLE G-23

PAST AND PROJECTED CIVILIAN EMPLOYMENT IN THE MAJOR BELTS OF DEVELOPMENT AND THEIR COMPONENT WATER RESOURCES PLANNING AREAS, 1940-2020
NORTH ATLANTIC REGION

Water Resources Planning Areas	1940	1960	1980	2000	2020
			(in thousands)		
Coastal Belt	9771	13740	18142	22901	28299
Boston	1580	2042	2591	3224	3927
Hartford	890	1283	1680	2132	2664
New York	4550	6248	7972	9649	11488
Philadelphia	1453	2103	2810	3592	4496
Baltimore	519	740	1004	1286	1591
Washington	605	1035	1677	2480	3439
Norfolk	174	289	408	538	694
Middle Belt	1997	2561	3263	4046	4970
Manchester	125	174	237	312	400
Albany-Troy	303	361	433	528	631
Syracuse	313	410	537	676	847
Allentown	385	511	603	688	800
York-Lancaster	639	798	1044	1319	1637
Richmond	232	307	409	523	655
Outer Belt	932	1157	1487	1844	2265
Portland	185	219	267	313	367
Upper Connecticut Valley	92	103	122	144	167
Burlington-Rutland	82	98	126	160	199
Binghamton	246	314	412	520	656
Williamsport	112	147	185	230	279
Staunton-Winchester	63	86	127	168	219
Roanoke	152	190	248	309	378
North Atlantic Urban Region Areas	12700	17458	22892	28791	35534
United States Excluding Overseas	45066	64582	90820	120871	157386

Source: Regional Plan Association, Study of Present and Projected Urban Development and Land Use in North Atlantic Region Preliminary Issue), part 2, Table A-3, p. 20.

TABLE G-24

PAST AND PROJECTED CIVILIAN EMPLOYMENT IN THE MAJOR BELTS OF DEVELOPMENT, THEIR RATES OF GROWTH AND SHARE IN REGION TOTAL, 1940-2020

NORTH ATLANTIC REGION

Area	Rates of Growth in Percent			
	1940-1960	1960-1980	1980-2000	2000-2020
Coastal Belt	40.6	32.0	26.2	23.6
Middle Belt	28.3	27.3	23.8	22.8
Outer Belt	24.1	28.6	23.9	22.8
NAR Urban Areas	37.5	31.1	25.8	23.4
United States Excluding Overseas	43.3	40.6	33.1	30.2

	Share of Total Region in Percent				
	1940	1960	1980	2000	2020
Coastal Belt	76.9	78.7	79.2	79.5	79.6
Middle Belt	15.7	14.7	14.3	14.1	14.0
Outer Belt	7.4	6.6	6.5	6.4	6.4
NAR Urban Areas	100.0	100.0	100.0	100.0	100.0

Source: Regional Plan Association, Study of Present and Projected Urban Development and Land Use in North Atlantic Region (Preliminary Issue), part 2, Table A-4, p. 21.

TABLE G-25

PAST AND PROJECTED POPULATION OF MAJOR BELTS OF DEVELOPMENT, THEIR RATES OF GROWTH AND SHARE IN URBAN TOTAL

NORTH ATLANTIC REGION

Area	Rates of Growth in Percent			
	1940-1960	1960-1980	1980-2000	2000-2020
Coastal Belt	34.7	26.1	25.8	24.2
Middle Belt	15.7	20.4	23.3	23.1
Outer Belt	15.4	19.3	22.4	22.4
NAR Urban Areas	29.9	24.7	25.2	23.9
United States Excluding Overseas	35.7	30.6	31.0	29.6

	Share of Total Region in Percent				
	1940	1960	1980	2000	2020
Coastal Belt	75.2	77.9	78.8	79.1	79.3
Middle Belt	16.9	15.0	14.5	14.3	14.2
Outer Belt	7.9	7.1	6.7	6.6	6.5
NAR Urban Areas	100.0	100.0	100.0	100.0	100.0

Source: Regional Plan Association, Study of Present and Projected Urban Development and Land Use in North Atlantic Region (Preliminary Issue), part 2, Table A-2, p. 19.

URBANIZATION PROCESSES AND TRENDS

The Redistribution of Population and Economic Activity

Urban growth has continuously spread beyond the political boundaries of the region's central cities, transforming rural land into urban uses, and resulting in a pattern of physical sprawl. As a social process, urbanization has also absorbed much of the region's rural population who, through the acquisition of new skills, have climbed the rungs of the economic ladder. The process of social mobility has worked through the economic mechanism, manufacturing being the activity most closely associated with such advancement in the past.

Because of the initial reliance of manufacturing on water or rail transportation, the bulk of manufacturing development was centered in cities. Here were the major break-of-bulk points as well as the large pools of labor, and the banking and commercial interests which were instrumental in financing new capital investment. The city was the least cost point and manufacturing activity sprang up in the downtowns of Philadelphia, Boston and New York, frequently around the port areas and rail junctures that also tended to occupy central space. Dependence on trolley lines precluded great separation between place of residence and location of employment, and further encouraged the clustering of activities at the center. With the rapidly evolving technology of transportation and manufacturing, however, the rate of industrial growth within central cities began to decline in relation to the surrounding metropolitan hinterland.

In the post-World War II period so much development occurred beyond the political boundaries of cities that the city itself has become simply the central node of a larger and rapidly growing metropolitan area. The sudden and dramatic decline in central city populations occurring between 1950 and 1960 is a reflection of this process and there is no indication that any spontaneous reversal is in sight.

Large cities have been declining in manufacturing which is being offset by an increase in central management and white-collar service activities. The most recent migrants to central cities, however, are those whose background, skills and education make them poorly equipped to enter white-collar growth fields. This incongruity between job and population characteristics in central cities has tended to exacerbate many of the chronic problems of city life, including deteriorating housing and over-taxed health, welfare, recreational and educational services and facilities.

At the same time as the principal central cities have been declining in total population, the proportion of their populations with non-urban backgrounds has been rising. A contradiction has

thus been created in which unemployment and poverty occur in our largest cities, even during periods of general prosperity and economic growth, particularly in the ghetto areas.

The Changing Population Composition of Central Cities and its Policy Implications

The two streams of urbanization and suburbanization represent different strata of the population responding to different conditions and susceptible to different pressures. Specifically, it has meant the movement into central cities of low-income persons of predominantly rural backgrounds of whom a high proportion have been Negroes from the agricultural south, and the movement into suburban areas of predominantly white, middle-income families.

In 1950, 64 percent of the U. S. white population was classified as urban, and 31 percent lived in central cities. In 1960, the white urban population increased 4 percent, but the percentage living in central cities declined 1 percent. In marked contrast, the black urban population increased from 62 to 72 percent during this same period, and the percentage of blacks living in central cities increased 11 percent.

This population redistribution coincided with an acceleration in the long-term trend of the suburbanization of those economic activities traditionally providing employment for unskilled and semi-skilled workers. Since the majority of Negroes now live in central cities, Negro employment problems are now, in large measure, a question of the central city's ability to absorb this group into the economic mainstream.

Caught between what appears to be contradictory economic and social forces, the region's largest cities face a crisis in fulfilling their historic function of assimilating the latest wave of rural-urban migrants. Solutions to this fundamental problem are basic to the formulation of public policy on urban development within the NAR. To simply accept as inevitable the continuation of past trends - central city decline in blue collar jobs and suburban exclusion of blue collar workers - raises serious doubts about the continued ability of the region's largest central cities to carry out their historic role as the foci within which the processes of social and economic mobility can go on.

This issue looms as one of the most important in devising a strategy for urban growth within the NAR, and has policy implications for a wide range of public programs, including planning or metropolitan transportation systems, manpower training programs, recreation and open space programs, and programs for new community development. All things being equal, those public actions that further metropolitan decentralization tend to weaken the vitality of the central city's economy and its ability to integrate the lowest social strata of the population into the local economy.

It has become obvious by now that the cities themselves have neither the political power nor the financial strength to solve the manifold problems confronting them, relying solely on their own resources.

EVALUATION OF URBAN DEVELOPMENT TRENDS

The Urban Crisis

Urban growth in the NAR, as in the rest of the country, is characterized by a long-term trend toward increased per capita consumption of land. Many factors are responsible: larger individual lot sizes, increasing automobile use, rising demands for public recreation, summer home development, larger sites for industry, airports, shopping centers, decentralized college campuses and campus-like research centers in rural settings.

Although some counter trends are appearing, the single family home is the dominant structural element in the suburban landscape. The great expanse of urbanized areas consists of small structures and minispaces. There is little to indicate that any sharp departure from this pattern will occur without strong and conscious public action. The prospect of 40,000,000 additional people in the NAR between 1960 and 2020, simply as an extension of the present pattern, may be expected to increase exponentially the multiple crises now confronting many of the region's cities and metropolitan areas.

The Transportation Crisis stems from the dispersed, underorganized development of land combined with the promotion of overmobilized private transportation and negligible support of public transportation systems. Besides being a large consumer of urban land, private transportation creates congestion precisely at the points it attempts to serve. The current pattern of suburbanization and reliance on the automobile results simultaneously in maximum congestion and maximum dispersion. The results are loss of potential open space, especially at the large scale; lengthened commuting time; and the growing severity of air pollution from exhaust emissions.

The Environmental Crisis is also related, to a significant degree, to the dispersed and underorganized pattern of land development. When development pressures occur within a proprietary and largely unregulated system of land development, physical disarray, both functionally and visually, is almost inevitable. Affluence, which contributes to the disarray, permits escape from the most affected areas and leads, in turn, to the further degradation of new areas.

This cycle has become inherent in the process of urban development. Many forms of technology, from jetports to electrical power generation and distribution systems, add to the problem for they

The values and advantages of urban life are virtually impossible to achieve with low density, barrack-like development.

The three-dimensional integration of a variety of urban activities through new design concepts offers the possibility of retaining greater amounts of open space at ground level.

The potential benefits of urban development arise with high net densities, affording urbanity, and low gross densities affording open space.

The loss of civic form leaves many municipalities with a weak center and a functionally irrelevant administrative boundary.

first make very exacting, large-scale demands on the environment and then contribute heavily to its general degradation.

The Social Crisis, less easily defined but no less real, points to what is perhaps the most critical condition of urban life. For many decades, sociologists have talked about the harsh anonymity of the modern metropolis. At the bottom of the problem of anonymity is the lack of a social focus simultaneously in the physical and the institutional pattern of the metropolis. With the evolution of urban society, "contacts" replace "association". The individual may become functionally and economically integrated but remains socially undifferentiated. Consequently there is a lack of identity either with place in the city or with the traditions of local institutions.

The Civic Crisis. The loss of civic form resulting from both dispersion and deterioration leaves almost every municipality with a weak center and a functionally irrelevant administrative boundary. While municipal jurisdiction is local, municipal problems are increasingly regional in scope. The absence of relationship between the physical urban pattern and the pattern of municipal or community institutions not only renders some problems insoluble, but makes the more penetrating questions difficult even to sort out and define. The gap that exists between the recognition and resolution of problems overwhelms civic aspiration. Experience in urban problem-solving at both the regional and the local level is a familiar source of frustration to citizens and administrators alike.

While the hard institutional problems of government and economics are tending toward metropolitan centralization of authority, the human problems call for localization in decision making. When either metropolitan consolidation or community "home rule" is attempted, a kind of civic psychosis seems to arise in which a rigid stalemate often defeats both effective centralization and decentralization.

These critical concerns cannot be ignored in long-range land and water resource planning for the NAR. They pose what are perhaps the greatest challenges for development in the coming decades - the mobilization of all our regional resources to help create a more humane urban environment.

Lessons for Future Urban Development

Clues to the improvement of future urbanization patterns arise from a variety of sources: the clustering of residential development; planned unit development; the "access tree" concept of the RPA; localized transit systems in use at world expositions; the comprehensive physical, social and institutional approach to community planning used at Columbia, Maryland; the sense of urbanity developed through urban design at Reston, Virginia.

By contrast, it appears that the major application of innovations developed largely between 1918 and 1945 - gross use segregation through zoning, isolated shopping centers, the freeway's promotion of mass private transportation, and the randomly located industrial district - have proven to be socially and functionally questionable. These developments grew out of the two principal forces affecting urban growth patterns: the processes of land sales and development, and the needs and capacities of the automobile.

What are some of the major lessons of the past half century that offer more positive directions for the next half century of urban development?

Urbanity and open space, the two most critical physical values of the city, tend either to reinforce or to defeat each other. They may be described as the two magnetic poles of urban life. Both can arise when urban development is clustered or concentrated. Even moderate clustering rapidly expands the availability of large open spaces without substantial additional acreage being required. On the other hand, urbanity is virtually impossible to achieve with low density and barrack-like development. By its nature it flourishes when intense and varied human interests and services are close at hand. Opportunities for extending as far as possible the benefits of urban development seem to arise with high net densities, affording urbanity, and relatively low gross densities, affording open space.

Efficiency in urban form involves two major considerations. First and foremost, it means planning for the individual in his daily pattern, to minimize the need for excessive movement. Immense savings of time and effort are possible. Urban efficiency depends upon minimizing the requirements for land consumption and mechanical movement, as, for example, in the planning of industrial layout.

Second, the efficiency of transportation improves as the urban structure it serves is focussed at relatively few points on lines converging on a common center. This means a cluster of concentrated developments - a bunch of grapes. Since distance as such is far less important in urban mass transportation than the density or distribution pattern of the people to be served, the distance between the urban growth clusters can be varied according to the qualities of the land-form or topography and the needs for open space, without affecting the essential unity of a metropolitan area.

The efficiency of a total transportation system is based on assigning each major mode its most appropriate role. At the micro-scale, walking is by far the most efficient form of locomotion if the physical environment is designed accordingly. It serves a social as well as a functional purpose, requires only very modest accommodations, and its inherent flexibility can be

readily enlarged through the use of high speed elevators and moving sidewalks. At the macro-scale of the metropolitan area, rail rapid transit is by far the most efficient means of mass travel. Like walking, its efficiency depends on planning to exploit its special characteristics. The automobile is valuable mainly for family recreation. Despite the expenditure of many billions of dollars to facilitate its use, it has serious limitations within central city areas.

The substance of the above points is that methods of integrating urban activities should prevail over the methods of segregating them that have dominated urban growth patterns in recent decades. Indefinite population growth spread out over an indefinite land area presents extremely difficult conditions for the adequate provision of urban amenities. Diversity of choice, close at hand, becomes virtually impossible to achieve. The segregation of major uses through zoning and the creation of density districts has not gotten to the root of this basic problem.

On the other hand, the three-dimensional integration of a variety of urban activities through new design concepts holds high promise for the future. There is growing interest in the concept of super buildings or megastructures where a diversity of households - families and individuals - will live, attend school, play, shop and work under one roof. Two feet of insulated wall or flooring in a super building provides a better divider between incompatible uses than reliance on 1000 feet of two-dimensional separation through zoning. Such a telescoping of uses offers the possibility of retaining greater amounts of open space at ground level. These conditions will also minimize the need for private vehicular transportation since a transit station under a super building can serve people efficiently without disturbing them.

Social integrity can be measurably improved through integrating the physical form of the city. Starkly evident in any tour of center city and suburb is how little the social importance of physical design has been understood. No matter how well conceived, however, the physical envelope is not the whole answer. Social integrity is likely to depend upon the creation of diverse forms of community, meeting individual and family needs, and, thus, helping to overcome the pervasive anonymity of the modern metropolis. The concept of community can well reinforce the approaches indicated for urbanity and open space, efficiency of urban form, and transportation efficiency, as well as the integration of urban activities.

Comprehensive urban planning is rapidly becoming an essential tool to manage the mass and complexity of the city and the exacting interrelated demands made on it. In itself, however, physical planning on a local basis has proven to be deficient in creating an efficient and socially healthy urban environment.

Great improvements in urban life seem possible only when everything bearing on living conditions is united in one approach (e.g., the fusion of land development, transportation, technology, industry, community and institutional development which is theoretically possible under large scale redevelopment of central areas or the coordinated planning and development of new communities). The need for linking comprehensive planning with metropolitan and regional development within a democratic and practical framework continues to pose a test of American creativity, but failure to do so is in itself a challenge to our democratic foundations.

EVOLUTION OF SOCIAL AND CULTURAL VALUES

Outlook on the Future

As formulated by RPA 1/ developed land projections for the year 2020 in the NAR vary from 14,600 square miles to 19,100 square miles between the most concentrated and the most dispersed alternatives. The actual range of possibilities may be far wider. Given a 50-year time horizon, it is unlikely that projections based on assumptions made in 1969 provide any more than the most approximate guide. This is because the key to the future pattern of land development depends upon life styles that will be adopted by as yet unborn generations, as well as upon new technology and the evolution of political and administrative mechanisms that are now merely ideas.

Development Constraints. With a doubling of population and growing public sensitivity to environmental issues, some constraints on ad hoc decision-making as it affects major changes in land use seem inevitable. In our approach to the building of cities, and specifically to the utilization of land and the development of urban space, the freedom to buy, dispose and develop may need to be modified in the interests of society. Such constraints will apply equally to private developers and public agencies. In the future, given the enormous land resources of the NAR, the question of how, rather than how much, land is used for urban purposes may be far more important in metropolitan planning.

Applications of Technology. As a general rule, technology has been overwhelmingly applied to promote consumption. In the early period of industrialization this was entirely justified, but today it is becoming increasingly questionable as a means of enhancing the quality of life. In some instances, as with the automobile, the best interests of the city have been subordinated in the process. The problems resulting from misapplication of technology raise the need for additional technology to overcome some of the critical situations that have been created by its uncritical and unrestrained adoption.

1/ See map in pocket on back cover for RPA's Developed Land Projections.

It is entirely possible, however, to envision the application of technology to cities in such a way that it not only resolves certain problems of its own use but also enhances many of the possibilities of urban living. Improved building systems, particularly those that permit the construction of super buildings and large-scale planned unit developments could greatly assist in achieving a re-integration of urban activities with gains in both efficiency and environmental quality. Utilities, industry and transportation - three major water and air pollution sources and the three major activities giving rise to problems of conflicting land use - could well be incorporated into the design at the micro-scale of the development unit as well as at the macro-scale of the region or metropolitan area.

Little has been done thus far about urban-related technology. One of the areas most in need of effective technology is underground transportation. Automatic delivery of small merchandise appears to be feasible using gravity vacuum tubes in networks that function as part of an automated production, storage and distribution system. What seems to be missing more than the necessary technologies is the concept of a fully integrated multi-level transportation system for our cities.

Income and Consumption. A per capita income of $3,455 in 1970 has been projected to reach $13,315 in 2020. This increase in income may be far less important than the question of how it will be earned and how it will be spent. Emphasis is likely to shift toward extending the quality and variety of services and minimizing unnecessary burdens of the daily routine. Such matters are likely to prevail over concern with an unlimited expansion of goods.

The population of both the United States (over 70 percent urbanized) and the NAR (over 80 percent urbanized) consume material resources at an unprecedented rate. It is estimated that Americans, forming 6 percent of the world's population, consume almost 40 percent of its resources. In the long-term future, considerations of quality are likely to prevail over quantity, but the realization of qualitative improvements is intimately related to the national organization of urban existence.

Changes in the nature of work are likely to accompany or reflect shifts in values. The idea of careers is likely to shift from a concern with making as much money as possible to an emphasis on deriving the greatest amount of psychic income from one's work. There may be little tolerance for the long commutation trip, the costs of a second or third car, and the large and impersonal work organization. From the perspective even of work, there is likely to be a new emphasis on the general setting in which work takes place.

Just as industrialization reduced the importance of farm work, and automation has tended to reduce the relative importance of manufacturing employment, so will the computer and computer systems

inevitably reduce the need for large office forces and certain types of management activities. This is not to imply a decline in the tertiary sector as a whole, but its radical transformation.

Social services will probably continue to expand, particularly those affecting quality of life: education, the arts, travel and recreation, individual crafts, community traditions and celebrations. If the total proportion of one's life work (for money) continues to decline, the amateur may play a greater role, as compared to the professional. This would have the additional effect of placing greater emphasis on the setting in which activities take place, for the amateur participates not for gain, but out of personal interest. Inevitably, the place he is willing to spend his time, the environment to which he will become increasingly sensitive, would increase in importance.

Variety of Life Styles. Fifty years from now the individual is likely to demand much more of his society than earlier generations. At the same time, he may also want to make a greater contribution to his community or society, but in a way of his own choosing.

New demands for quality and for variety in life will multiply, with decreasing tolerance of poor services, particularly in the public sector. The availability of multiple services at one place may become more important to the individual or family unit than the quality of individual services that are separated spatially. Choice, convenience, efficiency and quality are demands that will place an immense burden on planning and design, not only of the whole city, but of each of its local environments - transportation, housing, work, and recreation.

National Emphasis on the Man-Made and Natural Environment. Given the inevitability of an urban setting that is larger and more complex technologically, the demands made upon the city will become far more exacting. Growing emphasis would be directed toward the functional integration of many elements of city life. Perfecting the man-made environment may come to be regarded as among the highest objectives of national development, and increasingly expressed in terms of social and cultural values.

Renewed concern with the man-made environment over the next 50 years is likely to be accompanied by intensified efforts to protect, preserve and enhance the natural environment. Within the time span of the projection period the population of the NAR will have become almost completely urbanized. Farm population will be less than 5 percent and rural population less than 15 percent of the total, the number of marginal and abandoned farms will increase, and a considerable proportion of uneconomic farm units will probably be purchased by urban residents as second homes during a part of the year.

MAP G - 10

is in a pocket

in the back

DEVELOPMENT POSSIBILITIES FOR FUTURE URBAN GROWTH

The Widening of Environmental Choice

Prior to the decade of the 1950's, the suburban as contrasted with the central city option carried with it associated environmental benefits - greater access to open space and visual beauty, less obvious pollution, more time for outdoor recreation. This situation is now changing and the increase of 40 million more people by the end of the projection period will change the amenity factor even more fundamentally.

The traditional "attributes" of suburban life - amenity, economic advantage, and social homogeneity - are progressively being diluted. The economic costs of suburban residence are rising; amenities have been declining as the landscape has been parceled into private mini-spaces and hacked into by super highways and shopping centers; and recent evidence points to at least the beginnings of black outmigration to heretofore all-white suburban areas, a movement that has the policy backing and legal sanction of the federal and some state governments.

At the same time conditions in central cities have worsened. Despite some notable examples of inner city rebuilding (e.g., Charles Center in Baltimore), physical deterioration, crime and institutional rigidities have made the central cities of the NAR's metropolitan belt less desirable for more people. Expanding the range of choice in residential environment available to all strata of the population - those who will be living within the central city, the suburb or the satellite center - should be a major plank in urban development policy for the NAR.

The prospect of a doubling of the NAR's population within the forecast period opens up two areas of consideration that are differentially relevant to public policy formulation with respect to future urban growth:

1. Alternative forms of city and metropolitan expansion

   How might the growth increment be distributed; are there alternative forms of city and metropolitan expansion that provide significant policy choices?

2. Alternative urban development patterns

   What design possibilities exist within differing forms of urban growth and to what extent are these design possibilities consistent with NAR objectives relating to national efficiency, regional development and environmental quality?

Alternative Forms of City and Metropolitan Expansion

A classification of alternative forms of future urban growth was recently devised by Anthony Downs.(8) The ten combinations that he set forth, while not exhausting the range of possibilities, is sufficiently inclusive to cover the major alternatives applicable on a broad regional basis. They are as follows:

1. Redevelopment of older neighborhoods in central cities of older suburbs through clearance and rebuilding. It has two forms:

    a. Unplanned redevelopment (by individual parcel-owners with resulting highly fragmented patterns).

    b. Planned redevelopment (under planned-unit development type of control).

2. Peripheral sprawl with unplanned development control, either on the edges of the continuously built-up portions of metropolitan areas, or beyond those edges but still within commuting range.

3. Planned peripheral growth on the edges of the continuously built-up portions of existing metropolitan areas. It has two forms:

    a. Peripheral planned-unit development (under planned unit development types of control).

    b. Peripheral new cities (under comprehensively planned, citywide type of control).

4. Satellite growth, beyond the continuously built-up portions of existing metropolitan areas but within commuting range of them. It has three forms:

    a. Scattered satellites (under planned-unit development type of control).

    b. Satellite new cities (under citywide type of control but not contiguous to existing smaller communities).

    c. Satellite expanded cities (under citywide type of control but contiguous to existing smaller communities).

5. Nonmetropolitan growth beyond commuting range from any existing metropolitan areas. It has two forms:

    a. Nonmetropolitan new cities (under citywide type of control and not contiguous to any existing communities).

b. Expanded nonmetropolitan communities (under citywide type of control but contiguous to existing communities).

The classification established by Downs combines alternatives in metropolitan form with alternative patterns of development design. There is good reason to believe that local efforts to effect improved land use patterns through development design may be more successful than the almost herculean efforts that would be required to change the overall form or direction of growth for specific metropolitan areas. Furthermore, over the long-term, the diffusion of improved development design might, in itself, prove highly significant in effecting a more rational and efficient form of metropolitan expansion.

Patterns of Future Urban Growth

This section is intended to illustrate the land use consequences of a range of development patterns. As indicated in Table G-26 it is possible for some of the patterns to occur under varying forms of city or metropolitan growth. Also indicated in Table G-26 are the conditions of control under which each pattern would be most likely to occur. It should be kept in mind that while alternatives posed in schematically clear form are useful in clarifying basic advantages and disadvantages and in making comparative evaluations, they are, of course, inappropriate as direct models for development.

To facilitate the analysis, all alternatives are based on a specific density - 2,500, 7,500 or 75,000 persons per square mile - to be accommodated within a standard unit of one square mile in area or 640 acres. To highlight the acute differences in the pattern of land use resulting from each of the design prototypes, three of the alternatives are based on the same gross density, about 7,500 persons per square mile (a density about 25 percent higher than that assumed in the concentrated development alternatives of RPA described on page G-143.

Alternative I

Pattern of uncontained sprawl; relatively weak or ineffective land use controls; possible to occur almost anywhere but most likely to be found on the rural-urban fringe of a metropolitan area or central city; builders would tend to be small scale operators and individuals.

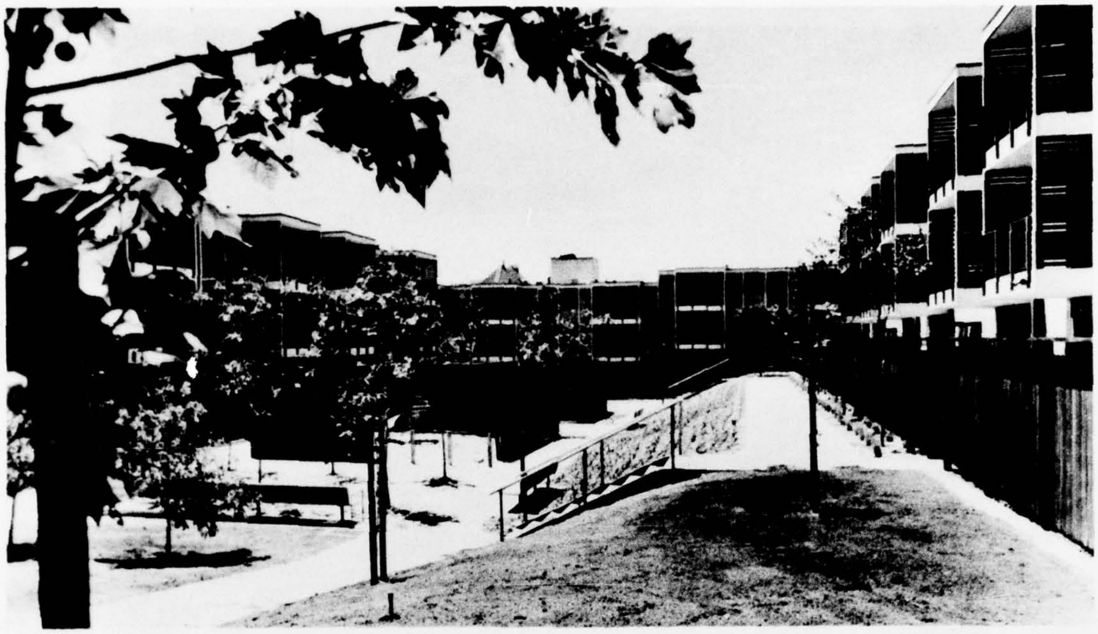
Characteristics. Low density, scattered development, approximately 2,500 people per square mile, predominantly single family residential development, some working farms but commercial agriculture in rapid decline, large amounts of vacant, idle land being held for speculation, highly dispersed pattern of services, almost total reliance on automobile transportation.

TABLE G-26

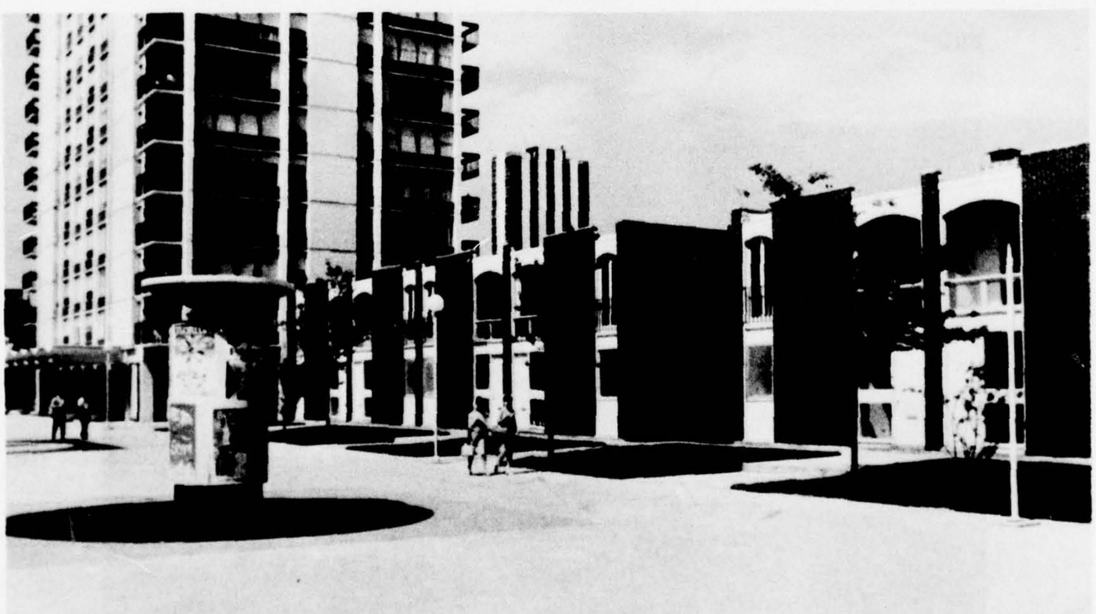
LAND USE CONSEQUENCES OF ALTERNATIVE URBAN PATTERNS
NORTH ATLANTIC REGION

Urban Form	Metro Periphery or Central City Periphery		Metro Periphery - Central City Periphery - Satellite City - New Town		Metropolitan Central City
Nature and Extent of Development Control	No Controls	Projection of Current Standard Practices	Diffusion of Innovations in Current Practice	Major Advances in Development Process	Major Advances in Development Process and in Urban Technology
Alternative Urban Patterns	I Uncontained Sprawl	II Contained Sprawl	III Clustered Planned Unit Developments	IV Super Buildings with PUD's	V Central City Super Buildings
Population (per sq. mi.)	2,500	7,500	7,500	7,500	75,000
Total Area (acres)	640	640	640	640	640
Area Allocations (acres)					
Man-made	630	600	250	60	180
Residential	450	400	135	NA	NA
Community Center	40	60	60	NA	NA
Industry	20	20	20	NA	NA
Streets	120	140	25	20	20
Transit	None	None	10	10	10
Open Space	10	20	390	580	460
Intensive Recreation (Parks and Playfields)	na	na	100	110	220
Extensive Recreation	na	na	150	150	150
Water Bodies	na	na	10	20	20
"Urban Agriculture"	None	None	70	200	70
Forest	None	None	60	100	None

NA (No ground area allocation because of vertical integration)
na (No specific allocation because of small area involved)



The application of the clustering principle affords a sense of community, and incorporates usable open space into the immediate residential environment.



High rise development in association with low-rise residential clusters provides variety and choice in order to suit a wide range of needs.

Residential sprawl produces automobile oriented commercial development with parking taking the greatest amount of space.

Sprawl patterns, with low net residential densities, consume large amounts of land and make dependence on the automobile essential for all types of trips -- school, shopping, work and recreation.

Conditions. High ratio of small private structures and spaces, low ratio of large public open spaces, enforced travel long distances in many directions, considerable degree of isolation for nondriving members of households, low level of urbanity and relatively low level and variety of service with high cost of access.

Alternative II

Pattern of contained sprawl; controlled by zoning and subdivision practices now in current use; most likely to occur in older suburbs and suburbanizing areas with a relatively high degree of land saturation; builders would range from small to large.

Characteristics. Moderate density, relatively high degree of land coverage, predominantly single family but with scattered multiple family dwellings averaging 5.5 dwelling units per acre, strip commercial along highways, scattered vacant lots, low availability of large vacant sites, commercial agriculture has disappeared, some high value truck gardening remains as well as nurseries and greenhouses.

Conditions. Largely the same as sprawl but with moderate improvement in access to services. Relatively large community centers or nodes for shopping, school, parks and public buildings would provide a measure of convenience and a focal point for social activities to evolve.

Alternative III

Pattern of clustered planned unit developments; control would be based on the adoption of innovations in zoning that are slowly gaining acceptance at present; might apply to a wide range of areas including the periphery of the metropolitan area or central city, in satellite cities or in new towns; builders would tend to be moderate to very large.

Characteristics. High net densities, two-story row house dwellings, low degree of land coverage at the gross grain, mixed public and private transportation, central development of commercial and public services, segregated industrial development.

Conditions. Small private outdoor spaces (verandas or small gardens), large and varied common open spaces, public travel to the most important points, increased convenience of most services and a possible degree of urbanity at the center of development. Open space in each square mile amounts to more than 70 percent of the land.

Alternative IV

Pattern of high rise, super building development in association with clustered planned unit developments; controls would be

based on major advances in the development process including density transfer and other flexible arrangements that would necessitate considerable discretionary powers over the administration of controls; builders would be large to very large and experienced in different areas of industrial production and technology.

Characteristics. High net densities and multiple use of interior building space; integrated building system providing optimum conditions for walking, transit and automobile use.

Conditions. Private spaces on verandas, some at walk-in locations; public open spaces cover more than 90 percent of area; all ordinary living, working, shopping, recreation, education and health activities incorporated within or adjacent to the building; urbanity and open space maximized.

Alternative V

Pattern of super buildings dominating the inner city structural landscape; dependent on major advances in the development process and in the application of urban technologies; capital requirements, scheduling, coordination, etc., would eliminate all but the largest and most efficient industrial builders.

Characteristics. Super high densities of 75,000 persons per square mile approximating that of Manhattan, otherwise same as Alternative IV.

Conditions. Basically the same as Alternative IV but with about two-thirds of the land reserved as permanent public open space. The need for private automobiles for daily use would be almost totally eliminated; cars would be used extensively for weekend family recreation.

Evaluation of Alternatives

In considering the long-range development of water and related land resources within the NAR, the staff of the NAR Water Resources Study Group has adopted three objectives: environmental quality, regional development and national efficiency. The Study Group has stated these objectives as follows:

> Under the environmental quality objective . . . there is emphasis on those benefits that are not associated with the market place. Visual enjoyment, wilderness and cultural amenities are examples of these . . . . Under the regional development objective the emphasis will be on the fulfillment of regional aspirations. Benefits and costs under this objective are measured in relation to their impact on the well being and the aspirations of the region as a whole . . . . Under the national efficiency objective, the emphasis is directed towards the goal of the nation as a whole.

This many-faceted approach to the region's water and related land resources is relevant, too, for the region's urban resources. However, at this stage in our knowledge of the costs and benefits of alternative patterns of urban development, it is impossible to apply these objectives with any degree of precision. The intricacy of the urban fabric, with its interlocking relationships among activities, people and physical resources, would require a level of analysis that is beyond the scope of the project during this phase. Nevertheless, a subjective evaluative procedure has been devised.

Methodology. Table G-27 represents an attempt to evaluate schematically but comprehensively the five alternative urban development patterns with respect to national efficiency (NE), regional development (RD), and environmental quality (EQ). In order to do this a series of 26 sub-objectives were posited.

The sub-objectives are grouped in three categories: Particular Public Sub-objectives (relating to government), Particular Private Sub-objectives (relating to individuals and families), Particular Business Sub-objectives (relating to commercial and industrial enterprise). These 26 sub-objectives are derivatives of 5 composite sub-objectives that are regarded as key components or values of urban life: Urbanity, Open Space, Efficiency, Community and Choice. The importance of each of these components to urban life has been elaborated upon in earlier sections of this report.

A four-level scale of evaluation is applied to each of the 26 sub-objectives: High (H), Moderate (M), Low (L), Negative (X).

Each sub-objective is deemed to be most relevant to one of the three objectives (NE, RD or EQ) established by the NAR study and the "score" is entered in the respective column. For example, sub-objective 1, "Maximize local govt. effectiveness" was assigned to the RD objective. For Alternative I (Uncontained Sprawl), it was negatively affected and an "X" appears in the column. Alternative III (Clustered Planned Unit Development) was deemed to have a moderately positive impact on local government effectiveness and the score "M" is entered in the column.

For purposes of arriving at a composite evaluation each letter score was given a numerical weight: X, -1; L, +1; M, +2; H, +3.

Assumptions. In order to arrive at a composite score the following assumptions were made:

Urbanity is most relevant to RD and is a composite of the following sub-objectives:

12. Variety in social environment
15. Opportunity for association
17. Accessibility to commercial services

TABLE G-27

MULTI-OBJECTIVE EVALUATION OF ALTERNATIVE URBAN PATTERNS
NORTH ATLANTIC REGION

Alternative Urban Patterns	I			II			III			IV			V		
Primary Regional Objectives	NE	RD	EQ	NE	RD	EQ	NE	RD	EQ	NE	RD	EQ	NE	RD	EQ
Composite Public and Private Subobjectives															
A. Urbanity (12, 15, 17)		-3			1			5			9			9	
B. Open Space (7, 11, 18)			-1			-1			7			8			9
C. Efficiency (16, 19-26) (2-5)	9	4		16	5		18	9		26	10		26	10	
D. Community (1, 6, 14)		-1			-1			8			9			9	
E. Choice (8-10, 13)		1			-2			7			12			10	
TOTAL	9	1	-1	16	3	-1	18	29	7	26	40	8	26	38	9
Particular Public Subobjectives															
Maximize															
1. Local government effectiveness		X			X			M			H			H	
2. Use of new transportation technologies		X			L			M			H			H	
3. Options for physical adjustments to meet future needs		L			X			M			H			H	
Minimize															
4. Capital costs		H			M			M			L			L	
5. Operating expenses		L			L			M			H			H	
6. Urban obsolescence		X			M			H			H			H	
7. Environmental degradation			X			X			M			H			H
Particular Private Subobjectives															
Choice in															
8. Life styles		L			X			M			H			H	
9. Transportation mode		X			X			M			H			M	
10. Tenure (own or rent)		X			X			L			H			M	
Variety in															
11. Visual environment			L			X			M			M			H
12. Social environment		X			L			M			H			H	
Opportunity for															
13. Privacy		M			L			M			H			H	
14. Participation		X			L			M			H			H	
15. Association		X			L			L			H			H	
Accessibility to															
16. Employment centers	X			L			M			H			H		
17. Commercial services		X			X			M			H			H	
18. Public open space			X			M			H			H			H
Particular Business Subobjectives															
Availability of															
19. Labor market	X			L			M			H			H		
20. Consumer market	L			M			M			H			H		
21. Utilities	L			M			M			H			H		
22. Industrial sites	H			M			M			H			H		
23. Commercial sites	L			M			M			H			H		
24. External economies	X			L			L			H			H		
25. Efficient transport	M			M			M			H			H		
26. Expansion area	H			H			H			M			M		

Open Space is most relevant to EQ and is a composite of the following subobjectives:

7. Minimize environmental degradation
11. Variety in visual environment
18. Accessibility to public open space

Efficiency is highly relevant to both NE and RD and is a composite of the following sub-objectives:

2. Maximize use of new transportation technologies
3. Maximize options for physical adjustments to meet future needs
4. Minimize capital costs
5. Minimize operating expenses
16. Accessibility to employment centers
19. Availability of labor market
20. Availability of consumer market
21. Availability of utilities
22. Availability of industrial sites
23. Availability of commercial sites
24. Availability of external economies
25. Availability of efficient transportation
26. Availability of expansion area

Community is most relevant to RD and is a composite of the following subobjectives:

1. Maximize local government effectiveness
6. Minimize urban obsolescence
14. Opportunity for participation

Choice is most relevant to RD and is a composite of the following sub-objectives:

8. Choice in life styles
9. Choice in transportation mode
10. Choice in tenure (own or rent)
13. Opportunity for privacy.

Summary of Findings

Each of the alternative development patterns ranks as follows with respect to the primary NAR objectives:

		NAR Objectives			
	Alternatives	NE	RD	EQ	Total
I.	Uncontained Sprawl	9	1	-1	9
II.	Contained Sprawl	16	3	-1	18
III.	Clustered Planned Unit Development	18	29	7	54
IV.	Super Buildings with PUD's	26	40	8	74
V.	Central City Super Buildings	26	38	9	73

Uncontained Sprawl. Its strength relative to NE is largely derived from the availability of industrial sites and site expansion area, and efficiency in goods transportation. It ranks negatively as far as labor market availability and availability of external economies. Its contribution to RD is minor and its effect on EQ is negative.

With regard to the quality of Urbanity, it has a high negative value because of poor access to services, the lack of variety in social environments and the absence of opportunity for a wide range of associations. Since there is little public open space reservation and little variety in the visual environment, the Open Space objective is negative. The urban Efficiency objective is relatively low for the reasons given under NE above. Community receives a negative rating and Choice is rated as minimal.

Contained Sprawl. This pattern ranks significantly higher in NE than Uncontained Sprawl because of greater access to labor and consumer markets, and higher availability of utilities and external economies. However, its contribution to RD is little more than minimal and, like Uncontained Sprawl, its effect on EQ is negative.

Its effect on Urbanity is minimal because of poor access to services and a low rating with respect to variety in association and mix of social environments. The Open Space objective is negative because of the lack of variety in the visual environment. Its Community rating is also negative because of its effect on the efficiency of local government and the lack of variety in association. The objective of Choice is negated by the low levels of choice in life styles, tenure and transportation, as well as by the reduced opportunity for privacy.

Clustered Planned Unit Development. NE increases moderately with respect to labor market considerations. The RD objective is significantly furthered. This is due to considerable improvement in reducing the level of urban obsolescence and public operating

expenses and in improving conditions for local government effectiveness, the application of new transportation technologies, and flexibility in accommodating to future change.

Urbanity is significantly increased because of improved access to services and greater variety in the social environment. Opportunity for wide association remains rather low. The Open Space objective is also increased because of significantly greater public land reservation and greater variety in the visual environment. The urban Efficiency objective increases moderately as noted under NE above. The Community objective is significantly furthered because of its positive impact on local government effectiveness and minimizing urban obsolescence. Choice is also greatly increased by the provision of greater privacy, and a greater range in choice of tenure, life styles, and modes of transportation.

Superbuildings in Association with Planned Unit Development. NE is markedly increased with consistently high ratings for employee access and labor market availability. Major gains also occur in external economies, efficiency of transportation and site availability for commercial and industrial firms. The RD objective also rises sharply because of improved economic factors, and a considerably greater range of choice, variety and opportunity due to improved access and mobility. EQ increases but not significantly.

Urbanity rises very sharply, the result of gains in accessibility to commercial service, opportunity for association and variety in the social environment. The Open Space objective is furthered but only marginally. Urban Efficiency also registers a slight increase, as does Community. Choice, also greatly increases with consistently high ratings for privacy and choice in life styles, tenure and transportation mode.

Central City Superbuilding. The NE objective remains stable and the RD objective declines slightly because of the more limited range of available choice. The EQ objective increases, but only minimally.

The urban related objectives of Urbanity, Open Space, Efficiency, Community and Choice remain relatively unchanged. Choice actually declines with respect to tenure and transportation mode.

A Preferred Course of Urban Development for the NAR

Urban Pattern. Of the five alternatives that have been examined, Clustered Planned Unit Development, and Super Buildings in combination with Planned Unit Development, appear to offer the maximum advantages in the planning of future urban growth within the NAR.

The most striking fact revealed by the comparative analysis is that neither population size nor gross population density are

the critical elements affecting open space, efficiency or the quality of life. What appears far more significant is the pattern of development. Those patterns that result in high net population densities yield significantly higher savings in land, increased efficiency, greater range of choice and greater mobility. Regardless of the population grouping involved, the Super Building, and to a lesser extent the clustered row house or Planned Unit Development pattern, permits a radical saving of large and varied open spaces. Such land conservation could be achieved in central city redevelopment, peripheral, satellite and new town development, particularly if site locations are planned in relation to intersecting transportation lines or modes.

The urban geometry of high net densities simultaneously creates the conditions for the two most important physical values of the city to be achieved: (a) urbanity: the intensity and variety of services, associations and interests close at hand, and (b) open space: woods, lakes and specialized agriculture at a scale of openness that permits an entirely different environment readily accessible to the residential setting.

With a doubling of population within the NAR, only major innovations in both the development design and the development process can secure and enlarge upon the more traditional values of ownership, privacy and mobility. The clustering of open space and the clustering of building space is complementary for quality urban development. Concentration or "clustering" through the super building concept opens up immense possibilities for urban efficiency by the integration of a wide array of activities. It provides not only an integrative framework for those who may occupy it, but establishes a "building block" with positive implications for the metropolis as a whole.

> It concentrates development for highly efficient point-to-point transport throughout the whole metropolis.
>
> It frees the automobile for its most natural use - family recreation.
>
> It takes advantage of the natural efficiencies of pedestrian movement without making walking a burden.
>
> It reduces or eliminates many sources of pollution, or provides efficient means to filter or collect all effluents.

Emphasis on development clustering at the micro-scale does not require commitment to a specific shape of development at the macro-scale. The latter is infinitely more difficult to achieve and of dubious significance to most persons.

Continuation of sprawl patterns, whether contained or uncontained, will, in the long run, result in large-tract land scarcity along the main corridor of development between Washington and Boston despite the large land area encompassed within the NAR as a whole. As a consequence of this, it would be possible to secure significant, varied, extensive spaces within the seaboard metropolitan band only at great expense and by great public determination.

Urban Form. While the long-range trend of in-filling between the major metropolitan areas is expected to continue along with further suburbanization outward from the region's smaller central cities, the specific physical form of city and metropolitan expansion within the NAR will inevitably be varied and conflicting. With its patterns of sprawl, the "Spread City" form of growth is expected to predominate.

Simultaneously, however, federal support for and corporate interest in new community development could result in establishing nodes of concentrated development even within a predominant pattern of extensive land development. In the short-term, such measures, however, will not materially affect the urban geography of the NAR as a whole. This does not mean that advances cannot be made in the direction of more desirable patterns of urban growth even within the predominant pattern of extensive development.

With growing concern for environmental quality, urban mass transportation and related issues, the nation may be on the verge of a new period in urban development that will be characterized by: coordinated land use and transportation planning on the metropolitan scale; the application of industrial technology to housing construction; and the entrance into the urban development arena of some of the largest, best capitalized and research-oriented segments of corporate enterprise.

In general, the major opportunity for invoking public measures for shaping growth will occur on a selective, localized basis and for specific reasons. It may be necessary, for example, to protect or preserve natural areas, sites of historic value or, in some special instances, to protect high-yield agricultural lands.

In the future, Inner City Rebuilding will be essential. The city is a single concentration by definition and by all the realities of economic, social and cultural interaction. Its rebuilding should be based on principles of urban efficiency and urban integration if it is to be successful. Super buildings, constructed in stages, can complement the best elements of the existing center, promote desirable levels of concentration, contribute to multi-use integration, reduce the need for automobiles, expand the availability of open space, and help rejuvenate public transportation. In time, clusters of super buildings could

encircle a metropolitan center and multiply concentrations of activity while increasing open space and reducing congestion.

New Towns in new locations will be essential to demonstrate the expanded possibilities of urban life through experimentation with an immense range of design possibilities. Fewer constraints exist in open areas, and building sites with poor quality for standard suburban development may prove desirable for high density new town development.

Existing suburbs will require re-orientation and rebuilding if they are not to become the slums of the future - even as many "gold coasts" declined to slums in the past. The vast suburbs built since the 1920's will likely require new and strong local centers, selectively developed higher densities, expansion of public open spaces, clear community boundaries, local connecting links to metropolitan transit, and vigorous local institutions. Shopping centers might be used as the foundation for multi-purpose community centers and highways as community dividers. Planning and design should be oriented so that the community may evolve toward a modest or high degree of clustering and integration over a period of decades, as the remainder of "suburbia" is amortized or reshaped.

For all of this, a stronger government role is necessary. Integration in urban activities will not be achieved without major changes in the development process. Issues of land use and disposition are central if metropolitan form and urban pattern are to be improved upon.

AGRICULTURE AND THE REGION'S ECONOMY

Agricultural Products and Trends

Crop Production

Acreage and production of the primary agricultural crops grown in the NAR are shown in Tables G-28 through G-36. These data are presented primarily as reference material, but certain observations are made concerning trends and production patterns. The three agricultural census years, 1954, 1959 and 1964 (9) provide a concept of trends that have developed in the agricultural industry. The types of crops grown describe the general types of agriculture. Crop production data show the relative economic importance of the various crop enterprises. Although there has been an acreage decrease in nearly all principal crops grown in the NAR, there has not been a corresponding trend in production.

Yield increases due to technological improvements and retirement of marginal land tend to compensate for acreage declines. Increases in the average size of farm is indicative of units failing

TABLE G-28

ACRES AND PRODUCTION OF FEED GRAINS[1/]
BY AREAS AND SUBREGIONS
1954, 1959 and 1964
NORTH ATLANTIC REGION

Subregion and Area	1954	1959	1964	1954	1959	1964
	(Thousand Acres)			(Thousand Bushels)		
Subregion A						
1	64.8	46.7	34.8	2,149.3	2,145.7	1,849.8
2	5.3	2.3	2.4	152.9	105.6	118.6
3	2.9	1.7	1.0	78.4	63.5	41.6
4	.6	.2	.2	19.1	9.6	7.9
5	1.1	.6	.3	29.8	21.1	10.1
Subtotal A	74.7	51.5	38.7	2,429.5	2,345.5	2,028.0
Subregion B						
6	.7	.6	.2	25.1	19.1	12.2
7	1.0	.7	.5	44.3	33.2	28.4
8	7.4	4.4	2.3	315.0	263.9	137.7
9	1.0	.7	.5	38.3	30.4	33.3
10	4.6	2.8	1.8	213.7	151.1	102.2
Subtotal B	14.7	9.2	5.3	636.4	497.7	313.8
Subregion C						
11	52.1	53.4	36.4	1,599.7	2,637.2	1,713.3
12	137.7	134.7	89.2	5,066.6	2,029.3	4,233.3
13	1.3	.6	.3	50.8	30.6	16.2
Subtotal C	191.1	188.7	125.9	6,717.1	4,697.1	5,962.8
Subregion D						
14	61.8	40.3	20.4	2,886.3	2,277.9	1,053.3
15	570.1	490.9	342.6	24,546.1	25,661.5	18,436.3
16	26.0	16.8	9.4	1,215.0	985.5	514.1
Subtotal D	657.9	548.0	372.4	28,647.4	28,924.9	20,003.7
Subregion E						
17	1,026.8	928.6	776.8	46,159.4	48,613.4	42,625.6
18	534.1	494.3	414.6	21,715.2	25,012.0	26,699.8
Subtotal E	1,560.9	1,422.9	1,191.4	67,874.6	73,625.4	69,325.4
Subregion F						
19	539.4	455.0	336.8	22,139.4	21,485.1	16,346.6
20	153.4	147.5	112.3	5,096.6	6,682.3	6,468.5
21	205.6	177.4	110.4	7,192.1	8,079.0	5,693.1
Subtotal F	898.4	779.9	559.5	34,428.1	36,246.4	28,508.2
TOTALS - NAR	3,397.7	3,000.2	2,293.2	140,733.1	146,337.0	126,141.9

1/ Feed grains include corn, sorghum, oats and barley.

Source: U. S. Census of Agriculture.

TABLE G-29

ACRES AND PRODUCTION OF SILAGE 1/
BY AREAS AND SUBREGIONS
1954, 1959 and 1964
NORTH ATLANTIC REGION

Subregion and Area	1954	1959	1964	1954	1959	1964
	(Thousand Acres)			(Thousand Tons)		
Subregion A						
1	.2	.1	.3	1.5	.7	2.1
2	2.1	1.9	3.6	18.0	21.9	33.6
3	3.0	2.3	5.8	22.2	25.9	57.1
4	1.4	1.4	3.1	13.3	16.8	31.1
5	1.1	1.3	2.5	10.6	15.5	26.5
Subtotal A	7.8	7.0	15.3	65.6	80.8	150.4
Subregion B						
6	3.3	2.9	5.7	27.0	30.5	54.1
7	9.3	8.5	13.5	82.8	98.9	134.7
8	32.1	29.0	39.7	323.0	356.5	439.6
9	12.3	9.7	15.9	84.7	98.2	149.1
10	23.8	23.0	39.8	244.2	287.0	475.7
Subtotal B	80.8	73.1	114.6	761.7	871.1	1,253.2
Subregion C						
11	72.4	58.2	86.4	592.8	567.2	807.5
12	134.9	128.2	174.6	1,092.8	1,221.6	1,412.2
13	2.0	1.2	1.5	17.8	12.3	18.3
Subtotal C	209.3	187.6	262.5	1,703.4	1,801.1	2,238.0
Subregion D						
14	15.0	10.1	18.6	133.9	101.3	155.2
15	91.7	73.8	128.7	767.0	795.8	1,137.8
16	2.1	1.9	2.1	20.5	21.3	17.7
Subtotal D	108.8	85.8	149.4	921.4	918.4	1,310.7
Subregion E						
17	229.0	194.9	334.9	1,971.8	2,091.5	3,037.8
18	36.8	30.9	67.0	336.3	347.4	638.1
Subtotal E	265.8	225.8	401.9	2,308.1	2,438.9	3,675.9
Subregion F						
19	87.4	82.7	193.3	786.3	890.8	1,685.8
20	18.4	17.2	33.4	143.6	198.9	333.1
21	16.1	21.0	34.6	136.3	197.8	328.9
Subtotal F	121.9	120.9	261.3	1,066.2	1,287.5	2,347.8
TOTALS - NAR	794.4	700.2	1,205.0	6,826.4	7,397.8	10,976.0

1/ Silage includes corn silage, sorghum silage and grass silage.

Source: U. S. Census of Agriculture.

TABLE G-30

ACRES AND PRODUCTION OF HAY[1/]
BY AREAS AND SUBREGIONS
1954, 1959 and 1964
NORTH ATLANTIC REGION

Subregion and Area	1954	1959	1964	1954	1959	1964
	(Thousand Acres)			(Thousand Tons)		
Subregion A						
1	83.3	42.0	37.1	93.7	56.3	49.1
2	74.5	65.8	54.7	93.1	85.9	70.9
3	131.0	127.4	106.5	149.2	158.3	132.8
4	58.2	53.0	42.4	68.6	69.3	56.5
5	89.4	81.2	66.6	105.0	99.0	79.2
Subtotal A	436.4	369.4	307.3	509.6	468.8	388.5
Subregion B						
6	113.7	109.2	83.8	136.8	125.6	90.9
7	137.6	113.6	90.7	215.6	181.8	131.8
8	395.2	349.7	281.2	606.4	541.0	406.4
9	64.1	58.6	45.7	114.7	104.0	68.5
10	176.4	151.9	122.3	309.9	275.6	199.1
Subtotal B	887.0	783.0	623.7	1,383.4	1,228.0	896.7
Subregion C						
11	869.1	812.7	769.0	1,431.0	1,310.0	1,235.5
12	812.5	775.7	742.3	1,360.5	1,297.9	1,076.8
13	8.8	6.0	5.4	16.4	10.8	7.3
Subtotal C	1,690.4	1,594.4	1,516.7	2,807.9	2,618.7	2,319.6
Subregion D						
14	70.8	56.8	54.9	121.0	112.6	91.6
15	682.1	629.1	533.8	1,152.6	1,196.0	901.9
16	17.0	10.7	7.8	31.3	23.8	17.7
Subtotal D	769.9	696.6	596.5	1,304.9	1,332.4	1,011.2
Subregion E						
17	1,439.7	1,444.4	1,449.1	2,363.3	2,653.1	2,242.0
18	246.0	204.3	169.9	334.6	399.8	289.2
Subtotal E	1,685.7	1,648.7	1,619.0	2,697.9	3,052.9	2,531.2
Subregion F						
19	645.9	656.5	616.1	849.3	1,158.2	809.0
20	126.4	126.8	116.9	138.2	188.7	157.2
21	240.6	221.0	194.0	261.2	316.9	220.9
Subtotal F	1,012.9	1,004.3	927.0	1,248.7	1,663.8	1,187.1
TOTALS - NAR	6,482.3	6,096.4	5,590.2	9,952.4	10,364.6	8,334.3

1/ Hay includes alfalfa, clover-timothy, small-grain hay, lespedeza, and other hay.

Source: U. S. Census of Agriculture.

TABLE G-31

ACRES AND PRODUCTION OF FOOD GRAINS 1/
BY AREAS AND SUBREGIONS
1954, 1959 and 1964
NORTH ATLANTIC REGION

Subregion and Area	1954	1959	1964	1954	1959	1964
	(Thousand Acres)			(Thousand Bushels)		
Subregion A						
1	0	.3	2/	0	7.5	.5
2	0	2/	2/	0	.3	1.4
3	0	2/	.1	0	.4	.9
4	0	2/	2/	0	.1	.5
5	0	0	2/	0	0	.2
Subtotal A	0	.3	.1	0	8.3	3.5
Subregion B						
6	0	.1	.1	0	3.5	2.3
7	0	.3	.3	0	4.6	6.9
8	0	1.1	.7	0	20.7	16.0
9	0	.8	.5	0	16.2	14.0
10	0	.8	1.0	0	17.0	23.5
Subtotal B	0	3.1	2.6	0	62.0	62.7
Subregion C						
11	2.1	1.3	.8	50.2	33.6	28.9
12	28.4	10.1	8.5	836.8	240.0	281.3
13	6.0	4.8	5.0	153.1	131.0	150.0
Subtotal C	36.5	16.2	14.3	1,040.1	404.6	460.2
Subregion D						
14	30.1	19.7	18.5	773.8	554.0	531.4
15	235.3	231.1	156.7	5,970.8	6,123.3	4,537.8
16	20.6	17.2	20.3	518.1	488.2	448.1
Subtotal D	286.0	268.0	195.5	7,262.7	7,165.5	5,517.3
Subregion E						
17	364.0	293.0	260.5	10,249.8	7,829.7	8,328.0
18	338.1	391.0	352.0	7,061.3	9,525.0	7,030.5
Subtotal E	702.1	684.0	612.5	17,311.1	17,354.7	15,358.5
Subregion F						
19	234.8	177.6	173.4	5,967.1	3,658.6	4,379.0
20	51.6	48.4	154.3	1,281.1	1,119.3	3,320.1
21	59.2	54.6	85.6	1,428.0	1,288.4	2,056.0
Subtotal F	345.6	280.6	413.3	8,676.2	6,066.3	9,755.1
TOTALS - NAR	1,370.2	1,252.2	1,238.3	34,290.1	31,061.4	31,157.3

1/ Food grains include wheat, rye and soybeans.
2/ Less than 50 acres.
Source: U. S. Census of Agriculture.

TABLE G-32

ACRES AND PRODUCTION OF IRISH POTATOES,
BY AREAS AND SUBREGIONS
1954, 1959 and 1964
NORTH ATLANTIC REGION

Subregion and Area	1954	1959	1964	1954	1959	1964
	(Hundred Acres)			(Thousand Bushels)		
Subregion A						
1	1,204	1,251	1,230	44,164	50,184	55,404
2	60	51	47	1,944	2,048	2,190
3	12	7	6	259	239	209
4	7	7	8	193	234	307
5	15	11	8	478	354	336
Subtotal A	1,298	1,327	1,299	47,038	53,059	58,446
Subregion B						
6	10	11	11	236	343	409
7	11	8	6	256	249	200
8	99	94	95	3,178	3,284	3,182
9	48	54	54	1,426	1,896	1,687
10	32	29	27	1,086	1,074	1,023
Subtotal B	200	196	193	6,182	6,846	6,501
Subregion C						
11	40	26	24	1,082	763	906
12	40	31	27	950	865	843
13	453	438	376	15,819	14,302	13,510
Subtotal C	533	495	427	17,851	15,930	15,259
Subregion D						
14	59	50	39	1,489	1,916	1,281
15	353	290	272	8,613	9,801	7,778
16	58	61	49	1,367	2,162	1,383
Subtotal D	470	401	360	11,469	13,879	10,442
Subregion E						
17	344	288	261	9,166	9,307	7,708
18	195	223	228	2,979	4,602	4,504
Subtotal E	539	511	489	12,145	13,909	12,212
Subregion F						
19	38	24	16	704	448	373
20	7	2	1	158	59	23
21	13	7	3	258	150	69
Subtotal F	58	33	20	1,120	657	465
TOTALS - NAR	3,098	2,963	2,788	95,805	104,280	103,325

Source: U. S. Census of Agriculture.

TABLE G-33

ACRES OF MISCELLANEOUS CROPS
BY AREAS AND SUBREGIONS, 1954, 1959 and 1964.
NORTH ATLANTIC REGION

Subregion and Area	Sorghum 1954	Sorghum 1959	Sorghum 1964	Peanuts 1954	Peanuts 1959	Peanuts 1964	Sweet Potatoes 1954	Sweet Potatoes 1959	Sweet Potatoes 1964
	(Hundreds)								
Subregion A									
1	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-
Subtotal A	-	-	-	-	-	-	-	-	-
Subregion B									
6	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-
Subtotal B	-	-	-	-	-	-	-	-	-
Subregion C									
11	-	-	-	-	-	-	-	-	-
12	3	25	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-
Subtotal C	3	25	-	-	-	-	-	-	-
Subregion D									
14	-	-	-	-	-	-	-	-	-
15	-	3	-	-	-	-	111	84	47
16	-	-	-	-	-	-	50	57	28
Subtotal D	-	3	-	-	-	-	161	141	75
Subregion E									
17	1	11	-	-	-	-	1	1	1
18	10	3	7	1	1	1	164	187	160
Subtotal E	11	14	7	1	1	1	165	188	161
Subregion F									
19	13	27	44	-	-	-	2	2	1
20	8	18	23	-	-	-	8	5	2
21	9	33	38	279	258	274	6	6	3
Subtotal F	30	78	105	279	258	274	16	13	6
TOTALS - NAR	44	120	112	280	259	275	342	342	242

Source: U. S. Census of Agriculture.

TABLE G-34

ACRES AND PRODUCTION OF TOBACCO
BY AREAS AND SUBREGIONS
1954, 1959 and 1964
NORTH ATLANTIC REGION

Subregion and Area	1954	1959	1964	1954	1959	1964
	(Hundred Acres)			(Thousand Pounds)		
Subregion A						
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
Subtotal A	-	-	-	-	-	-
Subregion B						
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	195	119	109	29,434	17,895	17,430
9	-	-	-	-	-	-
10	11	5	2	1,773	754	287
Subtotal B	206	124	111	31,207	18,649	17,717
Subregion C						
11	-	-	-	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
Subtotal C	-	-	-	-	-	-
Subregion D						
14	-	-	-	-	-	-
15	5	9	10	645	1,323	1,388
16	-	-	-	-	-	-
Subtotal D	5	9	10	645	1,323	1,388
Subregion E						
17	281	294	257	40,207	45,163	39,636
18	175	145	136	13,951	11,755	13,331
Subtotal E	456	439	393	54,158	56,918	52,967
Subregion F						
19	302	251	236	24,351	20,825	22,307
20	17	12	9	1,677	1,417	1,017
21	126	91	79	13,132	12,611	11,632
Subtotal F	445	354	324	39,160	34,853	34,956
TOTALS - NAR	1,112	926	838	125,170	111,743	107,028

Source: U. S. Census of Agriculture.

TABLE G-35

ACRES AND DOLLAR VALUE OF VEGETABLES HARVESTED FOR SALE,
ACRES OF DRY BEANS HARVESTED,
BY AREAS AND SUBREGIONS, 1954, 1959 and 1964
NORTH ATLANTIC REGION

Subregion and Area	Vegetables (Hundred Acres) 1954	1959	1964	Vegetables (Thousand Dollars) 1954	1959	1964	Dry Beans (Hundred Acres) 1954	1959	1964
Subregion A									
1	78	45	106	360	420	934	-	-	-
2	21	14	6	397	234	135	11	5	4
3	31	28	12	381	382	236	9	6	6
4	18	21	16	208	251	317	1	1	6
5	17	18	17	388	450	483	6	3	3
Subtotal A	165	126	157	1,734	1,737	2,105	27	15	19
Subregion B									
6	38	31	27	920	1,021	1,112	1	-	-
7	85	86	72	2,357	2,406	2,686	-	-	-
8	105	111	100	2,618	2,938	3,550	2	1	-
9	106	84	83	2,888	2,732	3,254	-	-	-
10	82	56	48	1,967	1,655	1,598	-	-	-
Subtotal B	416	368	330	10,750	10,752	12,200	3	1	-
Subregion C									
11	19	16	11	471	347	340	1	-	1
12	395	367	331	8,059	8,565	11,838	2	9	3
13	170	125	88	4,980	4,455	4,518	-	-	-
Subtotal C	584	508	430	13,510	13,367	16,696	3	9	4
Subregion D									
14	132	82	78	3,480	3,280	3,658	-	-	-
15	1,593	1,408	1,206	34,141	30,283	33,970	1	-	-
16	188	169	157	4,087	3,166	5,365	-	-	-
Subtotal D	1,913	1,659	1,441	41,708	36,729	42,993	1	-	-
Subregion E									
17	653	486	398	10,234	8,404	8,325	83	32	38
18	1,489	1,286	1,277	18,926	16,160	20,122	-	-	-
Subtotal E	2,142	1,772	1,675	29,160	24,564	28,447	83	32	38
Subregion F									
19	172	139	105	1,857	1,788	1,602	-	-	-
20	108	55	50	1,250	644	968	-	-	-
21	30	23	22	328	347	390	-	-	-
Subtotal F	310	217	177	3,435	2,779	2,960	-	-	-
TOTALS - NAR	5,580	4,650	4,210	100,297	89,928	105,401	117	57	61

Source: U. S. Census of Agriculture.

TABLE G-36

ACRES AND DOLLAR VALUE OF FRUITS AND NUTS HARVESTED FOR SALE, DOLLAR VALUE OF FOREST AND HORTICULTURAL SPECIALTY CROPS SOLD BY AREAS AND SUBREGIONS, 1954, 1959 and 1964.
NORTH ATLANTIC REGION

Subregion and Area	Fruits and Nuts			Fruits and Nuts			Forest 1/ and Horticultural		
	1954	1959	1964	1954	1959	1964	1954	1959	1964
	(Hundred Acres)			(Thousand Dollars)			(Thousand Dollars)		
Subregion A									
1	1	1	-	9	17	8	643	561	1,012
2	8	8	5	126	218	170	871	877	1,083
3	34	32	23	567	914	976	1,117	1,566	1,666
4	26	31	25	375	1,195	1,363	1,189	1,796	1,289
5	14	13	13	2,118	2,032	2,354	1,461	1,762	1,480
Subtotal A	83	85	66	3,195	4,376	4,871	5,281	6,562	6,530
Subregion B									
6	52	52	40	1,363	2,378	2,178	2,276	2,987	3,123
7	150	129	96	4,410	5,479	5,078	8,310	9,971	10,580
8	111	89	79	3,745	3,399	3,778	11,402	12,147	13,586
9	41	26	22	7,469	5,628	8,288	8,118	9,871	10,977
10	81	59	49	2,705	2,225	2,717	6,911	5,984	7,288
Subtotal B	435	355	286	19,692	19,109	22,039	37,017	40,960	45,554
Subregion C									
11	61	52	57	2,682	2,171	2,999	3,938	3,771	4,309
12	508	435	388	13,982	12,147	12,514	8,016	9,863	9,448
13	22	13	11	607	702	871	19,848	18,849	20,363
Subtotal C	591	500	456	17,271	15,020	16,384	31,802	32,483	34,120
Subregion D									
14	69	47	34	1,863	1,575	1,465	13,619	13,924	13,321
15	383	333	343	15,113	17,014	17,983	29,813	44,548	47,833
16	64	59	55	4,302	4,829	6,612	3,874	4,221	5,888
Subtotal D	516	439	432	21,278	23,418	26,060	47,306	62,693	67,042
Subregion E									
17	362	286	249	6,786	6,424	6,434	9,974	13,840	16,498
18	52	46	35	2,669	2,200	2,235	6,516	8,649	8,856
Subtotal E	414	332	284	9,455	8,624	8,669	16,490	22,489	25,354
Subregion F									
19	1,029	962	910	35,943	34,358	34,242	5,430	7,211	8,555
20	73	76	60	1,580	1,860	1,419	1,842	2,642	2,437
21	195	122	103	4,538	2,169	2,689	3,325	4,498	4,685
Subtotal F	1,297	1,160	1,073	42,061	38,387	38,350	10,597	14,351	15,677
TOTALS - NAR	3,336	2,871	2,597	112,952	108,934	116,373	148,493	179,538	194,277

Source: U. S. Census of Agriculture

1/ From farms only. Involves various stages of harvest and delivery points.

because of inefficiency. Urban expansion and highway construction have taken some of the better farmland. Most areas in the Region show a similar pattern of agricultural decline. No major shifts in production areas were apparent during the 10 year period from 1954 to 1964.

Feed Grains (corn, sorghum, oats and barley) largely support the eastern dairy and livestock industry. More than 55 percent of the Region's feed grain was grown in Subregion E (Susquehanna-Chesapeake Bay area) in 1964. Considerable quantities of feed grain are also produced in the Potomac and Delaware basins. Combined, these three areas provided 83 percent of the grain output in 1964. The northern three subregions A, B and C are low producers with only 7 percent of the total production.

Acreage of feed grain harvested in the Region has declined nearly a third from 3,397,700 acres in 1954 to 2,293,200 in 1964. None of the subregions experienced an acreage increase over this period.

Roughage production emphasis is shifting from hay to silage. Table G-29 presents the Regional trend in the acreage and production of silage. Production of silage in the northern areas is more significant than it was for feed grains. However, silage is still predominately grown in the southern subregions - more than 50 percent of what is grown in E and F. The general trend in acreage is up for silage in the Region with a 52 percent increase in the ten-year period from 1954 to 1964. This is compared to a 61 percent increase in production. Silage is considered to be a more efficient method of providing roughage to livestock and, therefore, is substituted to some extent for both feed grains and hay.

Hay acreage declined approximately 13 percent throughout the Region from 1954 to 1964 (Table G-30). Production declined by 1.6 million tons (16 percent) during the same period. Subregions C and E are the largest producers of hay with a combined 58 percent of the Region's hay production.

Food Grains (wheat, rye and soybeans) are concentrated largely in the three southernmost subregions D, E and F, which have nearly 99 percent of the Region's production. There has been a gradual decline in both production and acreage (Table G-31).

Since grains are easily transportable, competitive pressures are felt from the more efficient midwestern producers. Grains will continue to be an important eastern crop because of their value as a nurse crop, as a vital element in crop rotations and as a means of satisfying the demand for bedding straw by dairy farms.

About 50 percent of the total wheat acreage was grown in Subregion E in 1964. The Potomac and Susquehanna River Basins are major wheat producing areas. The decline in wheat acreage was similar to the decline in feed grains.

Fruits and Vegetables. Vegetable production is more than a 100 million dollar industry in the NAR. The concentration in particular areas adds considerably to the local economy. Over 50 percent of the vegetable acres are situated in the Delaware and Chesapeake Bay Areas. Among the other 19 Areas the acreage is about equally distributed (Tables G-35 and 36).

Fruit and nut crops are concentrated mostly in the Potomac River Basin although the Delaware and Hudson River Basins contain large fruit industries. The fruit industry of the Potomac River basin consists primarily of the apple industry in the Shenandoah Valley, Virginia, West Virginia and surrounding areas and the peaches and apples grown in southern Pennsylvania and eastern West Virginia.

Potatoes, like all other crops discussed thus far, except wheat, are grown to some extent in all Areas although almost 50 percent of the acreage occurs in the St. John River Basin. The Long Island Area is also an important potato producer. Significant quantities are produced in the Delaware, Susquehanna and Chesapeake Bay Areas. Potato acreage declined in most areas except in Area 1.

Econonomic Importance of Agriculture

In no other part of the country does agriculture feel the economic squeeze as it does in the NAR. It competes with numerous alternative uses of land. It competes for labor that is located in proximity to the industrial labor market. Much of the land is not adapted to present day agricultural technology. With these precepts in mind, it becomes desirable to examine the agricultural economy as to characteristics, trends, and economic importance in the NAR. Since 23 percent of the land is used for either cropland and/or pasture, it is necessary to look more closely at the general trends in agriculture to assess the impact on the various regional economies as well as those actively engaged in the agricultural industry.

By looking into the nature and characteristics of agriculture as well as the gross trends of land use, it is possible to assess the land use trends and make more reliable predictions of the future. Considerable differences are noted between areas and subregions, not only in terms of the magnitude of changes taking place in the agricultural economy but also in the direction of change in certain situations. As alternative uses replace agricultural uses, more information will be needed to determine the

impact on the regional economies, and the total effect on the environment in which future populations will live.

In most of the projections made for this report, population as well as agricultural, historical trends were moderated in the projected years. The reason is that although the agricultural economy has been in a period of rapid adjustment during the past 20 years, it is tending toward equilibrium and future adjustments will be much slower.

The large difference between rural and urban youth has lessened. It has become easier for either to move within each other's group with more social ease. The cultural lag in rural areas is not as apparent as television has brought much of the urban area to the farm. Rural education is better. Superhighways have lessened the time and distance between farm and city. Farmers at last have become a part of the mobile labor force and consider alternative investments for their capital.

Number and Size of Farms. Perhaps a more meaningful measure of farm economic activity is the amount of sales rather than the number of acres.

The amount of farm sales per farm is a better indicator of the number of farms that might cease to operate during the next decade. The farms were classified by the Census of Agriculture into commercial and noncommercial units on the basis of total farm sales. (Table G-37).

Almost one-third of the farm operators were noncommercial part-time or part-retirement. The greatest loss of farms will likely come from those with sales less than $10,000. The part-time farmers, those who work more than 100 days off the farm, are more likely to continue some sort of farm activity. There will be some farmers who switch from one classification to another and there will be some land renting or farm leasing by some of the less economic units in order to increase total sales. The farms with gross sales of less than $10,000 will find it increasingly difficult to compete. This represents 48 percent of the commercial farms. Add to this the part-time retirement farms and well over one-half of the farms will be retired from production or else the owner will have to be satisfied with a submarginal income.

Some differences in commercial farm income were noted between areas and subregions. Subregion A, particularly the St. John River Basin, has the highest percentage of commercial farms with sales over $40,000; whereas Subregion F has the greatest number of low income farms. In the four Subregions, B, C, D and E, the greater number of commercial farms were those with sales between $10,000 and $20,000 which accounted for approximately one-fourth of the commercial farms in each of the subregions. Subregions A and F were also peculiar in that the proportion of noncommercial to commercial farms was much higher.

TABLE G-37

NUMBER OF COMMERCIAL AND NON-COMMERCIAL FARMS BY ECONOMIC CLASS,[1/] BY AREA AND SUBREGION.

NORTH ATLANTIC REGION

Areas and Subregions	Total	Commercial I	II	III	IV	V	VI	Non-Commercial Total	Part-time	Part-Retirement
1	2,060	1,124	441	203	118	82	92	228	158	70
2	873	132	152	169	157	138	125	601	396	205
3	1,504	246	283	310	230	200	235	1,167	774	393
4	784	115	141	191	127	108	102	559	381	178
5	1,756	302	284	287	253	299	331	1,573	969	604
Subregion A	6,977	1,919	1,301	1,160	885	827	885	4,128	2,678	1,450
6	1,632	203	261	355	297	268	248	1,397	961	436
7	2,671	390	498	608	549	384	242	1,227	808	419
8	5,616	480	942	1,483	1,229	901	581	2,992	1,991	1,001
9	2,867	386	509	635	569	485	283	1,181	737	444
10	3,470	627	809	768	553	388	325	1,529	970	559
Subregion B	16,256	2,086	3,019	3,849	3,197	2,426	1,679	8,326	5,467	2,859
11	9,240	338	1,489	3,030	2,548	1,323	512	2,213	1,505	708
12	11,529	814	2,246	3,574	2,479	1,516	900	3,859	2,528	1,331
13	1,422	462	280	212	155	165	148	240	135	105
Subregion C	22,191	1,614	4,015	6,816	5,182	3,004	1,560	6,312	4,168	2,144
14	2,083	296	384	462	369	338	234	792	511	281
15	17,509	1,751	3,493	4,647	3,418	2,614	1,586	6,372	4,281	2,091
16	1,655	279	340	374	286	223	153	446	251	195
Subregion D	21,247	2,326	4,217	5,483	4,073	3,175	1,973	7,610	5,043	2,567
17	32,406	1,638	5,179	9,917	7,595	5,141	2,936	13,348	9,440	3,908
18	11,786	2,007	2,272	2,489	2,051	1,908	1,059	4,284	2,734	1,550
Subregion E	44,192	3,645	7,451	12,406	9,646	7,049	3,995	17,632	12,174	5,458
19	17,460	1,251	2,224	3,365	3,685	3,828	3,107	10,964	7,056	3,908
20	3,681	204	360	498	783	940	896	3,601	2,086	1,515
21	7,261	369	586	924	1,359	1,868	2,155	6,870	4,063	2,807
Subregion F	28,402	1,824	3,170	4,787	5,827	6,636	6,158	21,435	13,205	8,230
TOTALS - NAR	139,265	13,414	23,173	34,501	28,810	23,117	16,250	65,443	42,735	22,708

1/ Commercial farms were divided into six economic classes on the basis of the value of all farm products sold, provided the farm operator was under 65 years of age and he did not work off the farm more than 100 or more days.

Economic Class		Sales	Economic Class		Sales
I	-	40,000 or more	IV	-	5,000 to 9,999
II	-	20,000 to 39,999	V	-	2,500 to 4,999
III	-	10,000 to 19,999	VI	-	50 to 2,499

Source: U. S. Census of Agriculture.

Though there has been considerable loss of farms during the past two decades it is evident that more will be lost by economic attrition. The number whose sales are low is substantial in all subregions. In Subregion F the largest proportion falls in this group.

Farm Labor Replacement with Capital. Not only is there a loss of land for agricultural purposes but also a loss of people directly and indirectly dependent on the land as a source of income. This is borne out in Table G-38 which shows that the number of man-years required to produce agricultural products will decline. A man-year is defined as the number of hours a man works in a year. This figure was adjusted downward in succeeding years from the census year 1954. The number of hours a man was expected to work in the respective census years from 1954 were 2,180 hours; 2,130 hours; and 2,060 hours; and in the respective projected years from 1980 were 1,850 hours; 1,741 hours; and 1,736 hours. The downward adjustment was based primarily on adoption of improved technology and the assumption that farmers will desire more leisure time in future years. The labor requirement is a computed figure based on the number of hours required to produce a specific unit of an agricultural product.

TABLE G-38

ESTIMATED MAN YEARS UTILIZED FOR THE PRODUCTION OF AGRICULTURAL PRODUCTS, 1954, 1959, 1964 and PROJECTED YEARS 1980, 2000, 2020
NORTH ATLANTIC REGION

Subregion	1954	1959	1964	1980	2000	2020
A	17,314	13,939	12,824	10,500	9,400	8,000
B	50,526	38,716	35,102	25,200	19,000	15,200
C	81,635	62,892	59,112	46,100	37,400	30,400
D	67,614	48,559	41,223	28,500	21,200	15,300
E	124,151	98,293	92,999	72,600	57,700	46,800
F	88,925	68,756	72,736	58,200	47,000	37,800
NAR	430,165	331,155	313,996	241,100	191,700	153,500

Although a farmer will work fewer hours per year he will be able to produce more with his labor. This is due to greater mechanization, greater crop yields, and more rapid growth and production of farm animals through improved breeding and feeding. Man-hour requirement trends are based on agricultural production trends.

It is not possible to relate man-year labor requirements to number of people involved in agriculture as part of the labor requirement is met by part-time farm workers and also by family labor. Labor requirements declined 27 percent between 1954 and 1964 in the NAR. It is estimated that it will decline another

23 percent by 1980. The decline in labor requirements discussed here is due to replacement of man with various forms of capital to produce a product. The resulting high capitalization per acre would mean that treatment of the soil resources becomes more important. Erosion and flood control becomes of greater concern and importance to the farmer who has invested more per acre to make it productive.

It can be concluded that though the acreage used in agriculture will decline, intensity of agriculture will increase. Management of the soil resource will improve. Fewer people will work on the farm acre but the acre will be called upon to do more and hence will be protected more. Less productive acres or soils with more serious problems will continue to be used in agriculture but use will likely be more in line with capabilities.

The decline in labor requirements in the various subregions is a factor of the total and type of agricultural production expected and the gains in production efficiency in each of the various types of products grown in each of the subregions. Subregion F had the smallest decline in labor requirements between 1954 and 1964, 18 percent; whereas Subregion D had the greatest decline in labor requirements, 39 percent.

Farm Income. In planning the use of land or water resources the amount of income from the alternative uses is of prime importance. Most of the better farmland of the NAR lies along the coastal plain area that is in direct competition with the other uses. Any national program or policy affecting land and water resources of this area will generally result in some reallocation of land or water resources to other uses. An examination of farm income and the sources from which it is derived is useful in determining how the agricultural economy will be affected.

In 1964 gross farm income from farming was slightly greater than 2.8 billion dollars in the NAR (Table G-39). It is projected to increase slightly to just over 3.0 billion dollars in 2020.1/ Subregion E considerably outranks all other subregions in agricultural income produced.

1/ Base and projected income data were deflated to constant dollars to show the true growth of agriculture. Price deflators were obtained from "The National Income and Product Accounts of the United States", a supplement to the "Survey of Current Business", Table 8.5, pp. 162-163.

The agricultural income increase is due to increased yields per acre and increased production of animals due to better management, improved feeding efficiencies, greater use of fertilizer, improved plant and animal breeding, improved and increased control of agricultural pests and soil and water conservation practices. Technological improvement is expected to continue and though the size of the agricultural unit will continue to decrease in terms of land requirements it will be largely offset by improved technology.

The largest percentage increases were registered in Subregion A. Subregion F showed a large jump in 1980 but leveled off. Two Subregions, B and D, showed a decline in the importance of agriculture while all the others showed increases. Subregion B and D are characterized by large areas of urban expansion which probably accounts for much of the agricultural decline. Much of the future urban expansion will also occur in these two subregions. A large portion of the truck farming area of the NAR is in Subregion D which indicates greater need for future imports of vegetables.

TABLE G-39

GROSS FARM INCOME BY SUBREGIONS, 1964
AND PROJECTED YEARS 1980, 2000 and 2020
NORTH ATLANTIC REGION

Sub-regions	1964 Income	Projected Income					
		Estimated Income			Estimated Change		
		1980	2000	2020	1980	2000	2020
	(Millions of Dollars)				(Percent)		
A	203	240	300	315	+13	+42	+55
B	415	340	325	310	-18	-22	-25
C	485	499	530	600	+ 3	+ 9	+12
D	478	430	380	365	-10	-21	-24
E	835	910	955	1000	+ 9	+14	+20
F	393	440	450	455	+12	+14	+16
NAR	2810	2830	2940	3045	+ 1	+ 5	+ 8

Source: Farm income from the "Farm Income Situation" (10) was prorated among basins according to county agricultural sales from the "Agricultural Census".

Source of Income. Some differences were noted between subregions in the proportion of income derived from livestock and crop sales. In Subregion A there was a tendency for a greater proportion of the income to be derived from crop sales. Table G-40. Potato production in this area was the reason for this. Subregion D also accounted for a greater proportion of

income from crops than other subregions owing to vegetable production. Between 1954 and 1964 there were no shifts noted in any of the subregions from crops to livestock or vice versa.

TABLE G-40

SOURCE OF AGRICULTURAL INCOME BY SUBREGIONS
1954, 1959 and 1964
NORTH ATLANTIC REGION

Sub-regions	Gross Farm Income	From Crop Sales 1954	1959	1964	From Livestock Sales 1954	1959	1964
	(Million Dollars)	(Percents)					
A	203	52	44	59	48	56	41
B	415	31	30	34	69	70	66
C	485	27	23	26	73	77	74
D	478	37	38	41	63	62	59
E	835	27	23	24	73	77	76
F	393	34	29	31	66	71	69
NAR	2810	32	29	33	68	71	67

In Tables G-41 through G-44 data are presented on the various types of livestock enterprises and trends from 1954 through 1964.

Livestock. Slightly over two-thirds of the NAR agricultural income is derived from livestock or livestock product sales. Table G-40. The development of the livestock economy hinges upon favorable topography, abundance of rainfall, and grass. Much feed, however, must be imported to support the industry.

In general, the number of milk cows on farms has declined over the last two census periods. Subregions C and E have nearly 60 percent of the NAR dairy cows on farms while the Susquehanna River Basin alone accounts for nearly 28 percent.

Although the number of cows decreased in the NAR, production per cow increased substantially. Average production per cow increased from 5,996 pounds in 1954 to 8,567 pounds in 1964, up 43 percent. In 1964 the Region produced in excess of 19 billion pounds of whole milk worth about $937 million. Milk sales in the Region accounted for about one-third the value of all farm products sold. Areas 11, 12, 15 and 17 accounted for 65 percent of the value of milk and cream sold in the Region. The Susquehanna Basin alone accounted for 27 percent or $254.5 million.

The sale of sheep and lambs is of minor importance to the agricultural economy of the NAR. In 1964 only 347 thousand sheep and lambs were marketed with a total revenue of $5.6 million. This represents less than one percent of the total gross farm income

TABLE G-41

MILK COWS ON FARMS, WHOLE MILK SOLD,
AND VALUE OF MILK AND CREAM SOLD,
BY AREAS AND SUBREGIONS
1954, 1959 and 1964
NORTH ATLANTIC REGION

Subregion and Area	Milk Cows on Farms			Whole Milk Sold			Milk and Cream Sold		
	1954	1959	1964	1954	1959	1964	1954	1959	1964
	(Thousands)			(Millions of Pounds)			(Millions of Dollars)		
Subregion A									
1	14.4	8.0	6.7	45.9	46.0	39.2	2.0	2.2	2.2
2	18.0	15.2	12.7	100.1	119.1	104.4	4.6	6.1	5.5
3	29.0	26.8	23.4	150.2	202.5	184.0	7.0	9.8	9.8
4	13.4	12.9	11.4	69.4	94.2	97.0	3.4	5.0	5.3
5	18.1	14.9	11.5	79.9	95.4	85.2	3.8	4.9	4.6
Subtotal A	92.9	77.8	65.7	445.5	557.2	509.8	20.8	28.0	27.4
Subregion B									
6	25.4	20.8	18.3	138.7	147.0	153.0	7.0	7.9	8.8
7	52.6	42.5	37.3	339.2	391.9	343.6	17.5	22.0	21.8
8	150.4	126.6	110.6	872.0	974.2	913.5	42.1	50.4	49.7
9	46.9	39.7	33.5	336.1	292.5	321.4	18.3	17.7	20.6
10	92.0	76.9	69.0	603.3	658.1	632.7	32.0	37.5	38.0
Subtotal B	367.3	306.5	268.7	2,289.3	2,463.7	2,364.2	116.9	135.5	138.9
Subregion C									
11	335.0	298.2	292.0	1,942.6	2,108.0	2,294.8	76.6	93.3	102.8
12	347.1	320.8	307.9	2,328.9	2,535.9	2,791.6	95.3	116.7	126.4
13	6.0	3.7	2.7	48.6	32.8	26.5	2.8	2.1	1.7
Subtotal C	688.1	622.7	602.6	4,320.1	4,676.7	5,112.9	174.7	212.1	230.9
Subregion D									
14	43.0	33.7	27.8	316.3	288.8	262.2	17.3	16.0	14.5
15	349.8	310.7	274.6	2,313.1	2,444.5	2,467.7	104.8	120.0	125.0
16	7.1	5.2	3.1	49.6	27.2	28.5	2.6	1.5	1.7
Subtotal D	399.9	349.6	305.5	2,679.0	2,760.5	2,758.4	124.7	137.5	141.2
Subregion E									
17	647.0	626.9	613.5	4,116.6	4,958.3	5,449.6	165.6	219.4	254.5
18	130.2	109.7	92.8	733.0	749.9	777.2	32.2	33.7	39.0
Subtotal E	777.2	736.6	706.3	4,849.6	5,708.2	6,226.8	197.8	253.1	293.5
Subregion F									
19	253.2	236.9	213.1	1,213.7	1,598.8	1,684.7	54.4	72.1	81.9
20	42.7	34.2	27.3	138.4	199.9	190.5	7.2	10.3	10.3
21	65.3	48.8	38.1	177.3	257.0	231.9	9.5	13.8	12.9
Subtotal F	361.2	319.9	278.5	1,529.4	2,055.7	2,107.1	71.1	96.2	105.1
TOTALS - NAR	2,686.6	2,413.1	2,227.3	16,112.9	18,222.0	19,079.2	706.0	862.4	937.0

Source: U. S. Census of Agriculture.

TABLE G-42

CATTLE AND CALVES SOLD,
BY AREA AND SUBREGION,
1954, 1959 and 1964
NORTH ATLANTIC REGION

Subregion and Area	1954	1959	1964	1954	1959	1964
	(Thousands)			(Thousand Dollars)		
Subregion A						
1	11.2	6.9	8.1	726.8	591.2	713.1
2	15.3	12.7	12.6	698.0	817.9	735.6
3	26.0	26.1	25.9	1,091.2	1,669.6	1,587.1
4	11.7	12.9	12.8	522.7	735.5	792.1
5	13.7	12.3	12.9	607.3	914.7	805.2
Subtotal A	77.9	70.9	72.3	3,646.0	4,728.9	4,633.1
Subregion B						
6	22.7	20.7	20.8	1,112.4	1,528.6	1,320.2
7	43.9	45.4	40.0	2,000.0	3,041.8	2,484.5
8	124.5	111.1	109.3	5,130.3	7,088.2	5,811.4
9	38.1	29.8	34.3	1,853.5	2,081.6	2,407.3
10	75.1	72.0	69.2	3,298.5	4,848.4	4,439.2
Subtotal B	304.3	279.0	273.6	13,394.7	18,588.6	16,462.6
Subregion C						
11	256.0	245.5	258.7	7,011.5	12,034.0	10,524.3
12	282.1	271.1	301.4	10,711.7	15,813.7	18,720.6
13	5.5	4.0	3.8	431.4	355.0	395.8
Subtotal C	543.6	520.6	563.9	18,154.6	28,203.6	29,640.7
Subregion D						
14	38.3	31.1	31.7	2,409.7	2,402.8	2,146.0
15	326.8	309.6	309.6	18,949.1	26,387.0	23,172.9
16	7.8	4.2	5.0	521.7	430.8	541.8
Subtotal D	372.9	344.9	346.3	21,880.5	29,220.6	25,860.7
Subregion E						
17	617.7	664.0	713.4	47,367.2	71,515.2	63,752.7
18	150.9	136.1	146.6	11,685.5	16,720.3	14,690.6
Subtotal E	768.6	800.1	860.0	59,052.7	88,235.5	78,443.3
Subregion F						
19	382.3	414.5	434.4	31,164.3	53,060.4	42,838.5
20	75.8	79.9	80.9	5,791.3	10,207.6	8,465.3
21	124.1	125.7	131.4	8,785.1	15,051.7	12,045.8
Subtotal F	582.2	620.1	646.7	45,740.7	78,319.7	63,349.6
TOTALS - NAR	2,649.5	2,635.6	2,762.8	161,869.2	247,296.9	218,390.0

Source: U. S. Census of Agriculture.

TABLE G-43

HOGS AND PIGS SOLD ALIVE,
BY AREAS AND SUBREGIONS,
1954, 1959 and 1964
NORTH ATLANTIC REGION

Subregion and Area	1954	1959	1964	1954	1959	1964
	(Thousands)			(Thousand Dollars)		
Subregion A						
1	4.1	3.6	2.3	109.2	124.0	51.9
2	3.4	1.3	3.2	137.3	43.9	93.6
3	3.0	5.5	2.9	69.7	188.3	72.3
4	3.0	8.3	1.1	72.8	282.7	252.2
5	2.1	2.4	1.2	45.9	80.5	33.8
Subtotal A	15.6	21.1	10.7	434.9	719.4	276.8
Subregion B						
6	6.7	4.8	7.9	179.3	160.4	308.6
7	47.2	57.5	52.5	1,677.9	1,842.9	1,559.2
8	17.8	29.9	22.0	502.9	949.5	556.3
9	35.7	48.2	45.3	1,343.0	1,531.0	1,354.0
10	10.0	14.4	10.8	316.7	461.0	243.9
Subtotal B	117.4	154.8	138.5	4,019.8	4,944.8	4,022.0
Subregion C						
11	14.9	14.7	11.6	386.8	443.3	270.4
12	26.4	31.9	22.6	721.4	987.6	588.9
13	4.0	1.5	5.9	140.1	46.5	195.2
Subtotal C	45.3	48.1	40.1	1,248.3	1,477.4	1,054.5
Subregion D						
14	107.1	32.9	18.1	4,248.3	1,019.2	500.8
15	216.2	296.7	250.0	6,806.4	9,353.0	7,050.4
16	19.1	35.4	57.8	614.0	1,096.5	1,377.1
Subtotal D	342.4	365.0	325.9	11,668.7	11,468.7	8,928.3
Subregion E						
17	272.7	329.6	381.6	9,202.9	10,534.6	9,688.2
18	181.1	183.3	226.2	5,958.9	5,879.2	5,138.6
Subtotal E	453.8	512.9	607.8	15,161.8	16,413.8	14,826.8
Subregion F						
19	278.1	313.8	280.2	8,747.1	9,956.1	6,626.2
20	72.9	93.3	88.1	2,181.0	2,892.2	2,181.5
21	143.4	148.4	144.5	4,684.9	4,599.9	3,729.3
Subtotal F	494.4	555.5	512.8	15,613.0	17,448.2	12,537.0
TOTALS - NAR	1,468.9	1,657.4	1,635.8	48,146.5	52,472.3	41,645.4

Source: U. S. Census of Agriculture.

TABLE G-44

SHEEP AND LAMBS SOLD,
BY AREAS AND SUBREGIONS,
1954, 1959 and 1964
NORTH ATLANTIC REGION

Subregion and Area	1954	1959	1964	1954	1959	1964
	(Thousands)			(Thousand Dollars)		
Subregion A.						
1	3.8	4.9	2.5	49.0	63.6	29.9
2	2.7	3.0	3.6	35.6	39.6	54.0
3	3.2	4.2	4.1	39.8	54.8	47.2
4	.6	1.0	1.1	8.0	12.9	11.4
5	3.3	4.6	5.3	44.4	59.2	59.4
Subtotal A	13.6	17.7	16.6	176.8	230.1	201.9
Subregion B						
6	1.9	2.6	3.2	25.8	32.6	36.6
7	3.3	3.9	2.4	58.0	46.9	32.2
8	5.9	6.8	5.6	86.5	81.4	78.8
9	3.5	4.0	3.3	50.5	49.8	40.3
10	3.4	3.2	3.0	54.4	38.4	39.2
Subtotal B	18.0	20.5	17.5	275.2	249.1	227.1
Subregion C						
11	6.6	6.7	4.7	90.8	84.7	59.6
12	13.9	17.8	13.8	189.3	249.0	175.9
13	.7	.1	.3	10.6	1.5	5.6
Subtotal C	21.2	24.6	18.8	290.7	335.2	241.1
Subregion D						
14	5.1	6.0	4.0	94.2	78.2	55.9
15	20.2	20.4	22.0	296.6	263.6	334.6
16	.5	.5	.6	7.4	6.4	10.0
Subtotal D	25.8	26.9	26.6	398.2	348.2	400.5
Subregion E						
17	52.5	59.8	58.7	729.4	789.4	915.0
18	21.2	21.4	11.4	332.6	298.4	192.9
Subtotal E	73.7	81.2	70.1	1,062.0	1,087.8	1,107.9
Subregion F						
19	170.6	186.1	147.7	2,712.8	2,611.2	2,560.6
20	10.9	12.1	8.5	175.6	182.2	147.4
21	48.5	59.3	41.5	778.6	889.8	712.1
Subtotal F	230.0	257.5	197.7	3,667.0	3,683.2	3,420.1
TOTALS - NAR	382.3	428.4	347.3	5,869.9	5,933.6	5,598.6

Source: U. S. Census of Agriculture.

in the Region. Sales were concentrated primarily in the Potomac River Basin (Area 19) where 43 percent of the total sheep and lambs was sold. Even in this Basin the relative importance of sheep and lambs was small.

Egg and broiler production in the NAR has increased substantially during the last 10 years. Egg production has grown about 18 percent and broiler production by 54 percent. Egg production has been increasing in all Subregions but D. This was due to large decreases in Areas 14 and 16. Broiler production has declined substantially in Subregions B, C and D, and has become more heavily concentrated in the Delmarva Peninsula section of Area 18. Here nearly 60 percent of the broilers in the NAR were produced in 1964. Area 18 increased its share of the regional production by more than 10 percent from 1954 to 1964.

The number of cattle sold has remained relatively stable in the NAR over the last 10 years. The change in dollar value has fluctuated primarily because of price variation. The value of cattle and calves sold in 1964 represented about 8 percent of all farm product sales. Nearly 50 percent of the revenue from cattle and calves sales in the NAR in 1964 was from sales made in the Susquehanna and Potomac River Basins, Areas 17 and 19 respectively.

Swine production is concentrated in the three southern subregions of the NAR. Areas 15, 17, 18 and 19 accounted for 70 percent of the 1.6 million hogs and pigs sold in 1964. The number of hogs and pigs sold has shown little change over the past 10 years. Price fluctuations, however, have caused variations in total revenue from the sale of hogs and pigs.

FORESTRY IN THE REGION'S ECONOMY

The forests of the NAR provide many products and services to the people of the region. Among these are watershed protection, recreation, wildlife habitat, asthetics and wood products.

In general the northern sections of the region are dominated by softwood species such as white pine, spruce, and hemlock. The central, and southern upland sections are noted for their abundance of hardwood species, particularly the oaks, yellow poplar, and such valuable species as black cherry and black walnut. Loblolly pine and other typically southern species are dominant in the southern coastal section.

The Resource Base

Approximately 64 percent of the land area 1/ in the Region is in forest cover; 62 percent of land area is classified as

1/ County basis.

commercial. Subregion A has the largest portion of the total commercial forest land (25 percent) and Subregion D has the least (8 percent) (Table G-45). About 90 percent of the commercial forest is in private ownership; the remaining 10 percent is in public ownership (Table G-46). Only 3 percent of the commercial forest land is in National Forests while 7 percent is in state or local or other federal ownership. Of the private ownership 74 percent is in farm and miscellaneous private ownership; the remaining 16 percent is owned by forest industry.

Subregion A has the highest percentage of forest land in private ownership (99 percent) and in forest industry ownership (42 percent) and the lowest percentage of public ownership (1 percent). Subregion D ranks second in private ownership (90 percent) 89 percent of which is in farm and miscellaneous private ownership. The largest percentage of public forest land is in Subregion E. In this area the Commonwealth of Pennsylvania owns approximately 2.1 million acres of state forest and game lands.

The acreage of commercial forest land in the Region is expected to remain fairly stable throughout the projection periods (Table G-47). Losses in various subregions are expected to be compensated by increases in others resulting from conversion of marginal crop and pastureland to forest cover. The largest reduction in forest land is expected to occur in Subregion C (0.9 million acres) and the largest gain in Subregion E (1.9 million acres).

Growing Stock

Inventory. The inventory of growing stock volume on commercial forest land in the Region amounts to approximately 63.7 billion cubic feet (Table G-48). This volume is composed of 64 percent hardwood tree species and 36 percent softwoods.

Subregional inventories range from 4.3 to 16.4 billion cubic feet. Subregion D contains the least, 4.3 (7 percent) and A the largest, 16.4 billion cubic feet or 26 percent.

Hardwood makes up from 32 to 87 percent of the growing stock and is the major constitutent in five of the six subregions. In Subregion A softwoods constitute 68 percent of the inventory volume and comprise from 13 to 39 percent of the inventory in the other five subregions.

Growth. The estimated growth of growing stock on commercial forest land in the Region in 1962 amounted to over 2.2 billion cubic feet with a growth rate of approximately 3.5 percent. Hardwoods made up 64 percent and softwoods 36 percent of the growth.

TABLE G-45

LAND AREA BY SUBREGION AND AREA
BY CLASS OF LAND, 1963 1/
NORTH ATLANTIC REGION

Subregion and Area	All Land-Water Total	All Land-Water Land	All Land-Water Water	Forest Land Total	Forest Land Commercial	Forest Land Non-commercial	Non-forest
	(thousand acres)						
Subregion A							
1	4,279	4,205	74	3,871	3,858	13	334
2	4,873	4,547	326	4,151	4,036	115	396
3	4,182	4,018	164	3,451	3,444	7	567
4	1,642	1,588	54	1,368	1,367	1	220
5	4,257	3,655	602	3,103	3,067	36	552
Subtotal A	19,233	18,013	1,220	15,944	15,772	172	2,069
Subregion B							
6	2,604	2,409	195	1,895	1,883	12	514
7	2,410	2,305	105	1,896	1,861	8	436
8	7,218	7,101	117	5,592	5,503	89	1,508
9	3,198	2,855	343	1,735	1,718	17	1,120
10	2,982	2,928	54	1,989	1,980	9	939
Subtotal B	18,412	17,598	814	13,080	12,945	135	4,517
Subregion C							
11	6,181	5,845	336	3,744	3,254	490	2,101
12	9,444	9,199	245	5,105	4,144	961	4,093
13	1,578	1,329	249	574	545	29	755
Subtotal C	17,203	16,373	830	9,423	7,943	1,480	6,949
Subregion D							
14	1,415	1,370	45	547	519	28	823
15	8,817	8,680	137	4,330	4,235	95	4,349
16	1,329	1,215	114	647	627	20	568
Subtotal D	11,561	11,265	296	5,524	5,381	143	5,740
Subregion E							
17	16,198	16,103	95	8,996	8,834	162	7,106
18	4,927	4,423	504	1,308	1,297	11	3,115
Subtotal E	21,125	20,526	599	10,131	10,131	173	10,221
Subregion F							
19	9,357	9,230	127	5,311	5,096	215	3,924
20	3,447	3,312	135	1,936	1,888	47	1,376
21	7,715	7,506	209	5,218	5,084	134	2,287
Subtotal F	20,519	20,048	471	12,465	12,069	396	7,587
TOTAL NAR	108,053	103,823	4,230	66,740	64,241	2,499	37,083

TABLE G-46

AREA OF COMMERCIAL FOREST LAND BY SUBREGION AND AREA, BY OWNERSHIP CLASSES, JANUARY 1, 1963
NORTH ATLANTIC REGION

Subregion and Area	Total	National Forest	Other Public	Forest Industry	Farm-owned and misc. private
			Thousand Acres		
Subregion A					
1	3,858	--	49	1,641	2,168
2	4,036	--	49	1,784	2,203
3	3,444	--	10	1,865	1,569
4	1,367	45	8	329	985
5	3,067	--	49	951	2,067
Subtotal A	15,772	45	165	6,570	8,992
Subregion B					
6	1,883	127	36	93	1,627
7	1,861	--	131	21	1,709
8	5,503	466	287	965	3,785
9	1,718	--	115	10	1,593
10	1,980	--	177	1	1,802
Subtotal B	12,945	593	746	1,090	10,516
Subregion C					
11	3,254	126	142	685	2,301
12	4,144	57	190	419	3,478
13	545	--	3	--	542
Subtotal C	7,943	183	335	1,104	6,321
Subregion D					
14	519	--	6	--	531
15	4,235	--	456	43	3,736
16	627	--	73	--	554
Subtotal D	5,381	--	535	43	4,803
Subregion E					
17	8,834	--	2,109	335	6,390
18	1,297	--	47	63	1,187
Subtotal E	10,131	--	2,156	398	7,577
Subregion F					
19	5,096	480	336	182	4,098
20	1,889	17	72	219	1,581
21	5,084	539	130	632	3,783
Subtotal F	12,069	1,036	538	1,033	9,462
TOTAL-N.A.R.	64,241	1,857	4,475	10,238	47,671

TABLE G-47

COMMERCIAL FOREST AREA BY SUBREGION AND AREA, 1962, WITH PROJECTIONS TO 1980, 2000 and 2020 NORTH ATLANTIC REGION

Subregion and Area	River Basin or Area	1962	1980	2000	2020
		Thousand Acres			
Subregion A					
1	St. John	4,021	4,075	4,121	4,170
2	Penobscot	4,166	4,303	4,303	4,162
3	Kennebec	3,593	3,522	3,526	3,401
4	Androscoggin	1,422	1,310	1,392	1,392
5	St. Croix-Atl. Coastal	3,189	3,348	3,348	3,159
Subtotal A		16,391	16,558	16,690	16,284
Subregion B					
6	Presumpscot	1,964	2,071	2,021	1,922
7	Merrimack	2,252	2,323	2,323	2,030
8	Connecticut	5,699	5,780	5,780	5,405
9	Mass.-RI Atl. Coastal	1,470	1,550	1,429	1,066
10	Thames-Housatonic	2,053	2,104	2,101	1,953
Subtotal B		13,438	13,828	13,654	12,376
Subregion C					
11	St. Lawrence-Champlain	4,058	4,683	4,832	4,527
12	Hudson	4,617	5,311	5,792	5,301
13	New York City-L.I.	409	418	292	229
Subtotal C		9,089	10,412	10,916	10,057
Subregion D					
14	Passaic-Raritan	527	456	385	246
15	Delaware	4,316	4,238	3,800	3,353
16	Atlantic Coastal N.J.	645	696	659	595
Subtotal D		5,488	5,390	4,844	4,194
Subregion E					
17	Susquehanna	9,161	9,814	10,634	10,651
18	Chesapeake Bay-Delmarva	1,424	2,384	2,144	1,904
Subtotal E		10,585	12,198	12,778	12,555
Subregion F					
19	Potomac	5,327	5,442	5,614	5,120
20	Rappahannock-York	2,134	2,123	2,292	2,292
21	James	4,891	4,616	4,960	4,883
Subtotal F		12,352	12,181	12,866	12,295
TOTAL N.A.R.		67,338	70,567	71,748	67,761

TABLE G-48

ESTIMATED TIMBER CUT, GROWTH, AND INVENTORY OF GROWING STOCK ON COMMERCIAL FOREST LAND BY SUBREGION AND AREA, 1962

NORTH ATLANTIC REGION

Subregion and Area	Cut: All Species	Cut: Soft-woods	Cut: Hard-woods	Growth: All Species	Growth: Soft-woods	Growth: Hard-woods	Inventory: All Species	Inventory: Soft-woods	Inventory: Hard-woods
				(million cubic feet)					
Subregion A									
1	60.3	45.0	15.3	107.1	91.6	15.5	3893.0	2647.2	1245.8
2	75.1	55.7	19.4	116.7	100.7	16.0	4326.6	2934.8	1397.8
3	73.1	54.3	18.8	97.5	82.5	15.0	3548.9	2422.0	1126.9
4	25.6	19.6	6.0	35.9	30.3	5.6	1312.5	858.8	453.7
5	47.2	35.3	11.9	89.9	78.9	11.0	3268.6	2238.6	1030.0
Subtotal A	281.3	209.9	71.4	447.1	384.0	63.1	16355.6	11101.4	5254.2
Subregion B									
6	19.1	12.4	6.7	67.1	43.1	24.0	1994.3	1191.8	802.5
7	9.2	6.0	3.2	60.0	27.3	32.7	1707.6	755.4	952.2
8	63.9	41.4	22.5	181.9	81.2	100.7	5097.1	1997.8	3099.3
9	10.6	4.0	6.6	17.9	3.4	14.5	809.2	169.3	639.9
10	17.1	6.1	11.0	34.1	6.2	27.9	1465.4	159.1	1306.3
Subtotal B	119.9	69.9	50.0	361.0	161.2	199.8	11073.6	4273.4	6800.2
Subregion C									
11	42.0	11.8	30.2	120.5	26.2	94.3	4816.9	1070.4	3746.5
12	45.7	12.6	33.1	122.8	23.9	98.9	4874.2	973.7	3900.5
13	15.0	4.1	10.9	13.2	2.4	10.8	522.5	101.8	420.7
Subtotal C	102.7	28.5	74.2	256.5	52.5	204.0	10213.6	2145.9	8067.7
Subregion D									
14	7.4	2.7	4.7	9.6	2.9	6.7	324.9	69.8	255.1
15	34.6	7.7	26.9	198.2	14.7	183.5	3517.1	538.9	2978.2
16	2.7	1.6	1.1	10.7	.4	10.3	465.1	99.9	365.2
Subtotal D	44.7	12.0	32.7	218.5	18.0	200.5	4307.1	708.6	3598.5
Subregion E									
17	90.8	20.3	70.5	503.3	19.9	483.4	8537.8	761.2	7776.6
18	22.1	8.6	13.5	69.0	18.4	50.6	2357.5	674.7	1682.8
Subtotal E	112.9	28.9	84.0	572.3	38.3	534.0	10895.3	1435.9	9459.4
Subregion F									
19	67.0	24.3	42.7	156.7	26.4	130.3	5179.9	967.7	4212.2
20	54.5	30.3	24.2	69.2	37.5	31.7	1777.8	664.8	1113.0
21	129.0	70.2	58.8	150.7	76.1	74.6	3912.1	1351.3	2560.8
Subtotal F	250.5	124.8	125.7	376.6	140.0	236.6	10869.8	2983.8	7886.0
Total NAR	912.0	474.0	438.0	2232.0	790.4	1438.0	63715.0	22649.0	41066.0

* The inventory and growth data contained in this table were developed from the most recent forest survey data available and updated to 1962. The timber cut data were developed from the best available data for 1962. Because of the nature of this compilation the user is advised to keep in mind that they are subject to unquantifiable errors. Thus indicated cuts in excess of growth should be interpreted as meaning that an unfavorable growth-cut relationship may exist in this subbasin.

Subregion E accounts for about 26 percent of the growth of which 93 percent is in hardwoods. The growth in the remaining five subregions ranges from a low of 10 percent in Subregion D to 20 percent in Subregion A.

Hardwood constitutes the major percentage of growth in all subregions except A. Here softwoods made up approximately 86 percent of the total growth.

Cut. The estimated cut of growing stock in the Region is 912.0 million cubic feet. Softwoods make up 52 percent and hardwoods 48 percent. Approximately 31 percent of the total Regional growing stock cut is provided by Subregion A. Subregion F ranks second with 28 percent. Percentages in the other areas range from 5 to 13.

Subregion A provides 44 percent of the total Regional softwood growing stock cut. Subregion F is second with 26 percent. The remaining subregions provided from 3 to 15 percent.

Around 29 percent of the total Regional hardwood growing stock cut is provided by Subregion F. The remaining subregions provide between 7 and 19 percent.

Sawtimber

Inventory. The inventory of sawtimber volume on commercial forest land in the Region is approximately 128.5 billion board feet (Table G-49). The volume is composed of 63 percent hardwoods and 37 percent softwoods.

Subregions A and F have approximately 23 percent each of the total sawlog inventory while B, C and E average approximately 16 percent each. Subregion D has the least sawlog inventory (7 percent).

Subregions A and B have 41 and 20 percent of the Regional softwood sawtimber inventory. Hardwood inventory is largest in Subregion F, 25 percent, and ranges from 9 to 22 percent in the remaining subregions.

Growth. Sawtimber growth in the Region is approximately 5.3 billion board feet (Table G-49). Hardwoods make up 61 percent and softwoods the remaining 39 percent.

Approximately 46 percent of the Regional growth occurs in two Subregions: F, 27 percent, and A, 19 percent.

Softwoods species make up 30, 27, and 20 percent (77 percent) of the Regional growth in Subregions A, F, and B respectively. Hardwoods make up the major portion of growth in all Subregions except A. In A softwoods constitute 76 percent of the sawtimber growth.

TABLE G-49

ESTIMATED TIMBER CUT, GROWTH, AND INVENTORY OF SAWTIMBER ON COMMERCIAL FOREST LAND BY SUBREGION AND AREA, 1962

NORTH ATLANTIC REGION

Subregion and Area	Cut All Species	Cut Soft-woods	Cut Hard-woods	Growth All Species	Growth Soft-woods	Growth Hard-woods	Inventory All Species	Inventory Soft-Woods	Inventory Hard-woods
				(million board feet)					
Subregion A									
1	180	130	50	236	179	57	6,914	4,705	2,209
2	224	161	63	263	199	64	7,695	5,236	2,459
3	217	156	61*	215	163	52	6,304	4,288	2,016
4	75	56	19	80	61	19	2,326	1,584	742
5	141	102	39	197	149	48	5,803	3,949	1,854
Subtotal A	837	605	232	991	751	240	29,042	19,762	9,280
Subregion B									
6	65	41	24	161	101	60	3,722	2,513	1,209
7	31	20	11	160	100	10	2,916	1,723	1,193
8	215	136	79	430	185	245	9,575	4,657	4,918
9	42	21*	21	36	10	26	929	292	637
10	72	41*	31	77	11	66	2,039	273	1,766
Subtotal B	425	259	166	864	407	457	19,181	9,458	9,723
Subregion C									
11	147	39	108	348	81	267	10,255	2,781	7,474
12	160	41	119	364	75	289	10,656	2,570	8,086
13	52	13*	39*	40	8	32	1,152	273	879
Subtotal C	359	93	266	752	164	588	22,063	5,624	16,439
Subregion D									
14	20	6	14	29	7	22	760	139	621
15	106	21	85	304	40	264	7,144	1,259	5,885
16	6	3	3	42	10	32	1,096	201	895
Subtotal D	132	30	102	375	57	318	9,000	1,599	7,401
Subregion E									
17	280	57	223	688	63	625	15,921	1,981	13,940
18	320	269*	51	226	53	173	5,492	1,364	4,128
Subtotal E	600	326*	274	914	116	798	21,413	3,345	18,068
Subregion F									
19	274	67	207	616	178	438	12,611	2,656	10,046
20	200	83	117	250	119	131	4,746	1,723	3,023
21	478	193	285	552	263	289	10,429	3,786	6,643
Subtotal F	952	343	609	1,418	560	858	27,786	8,074	19,712
Total NAR	3,305	1,656	1,649	5,314	2,055	3,259	128,485	47,862	80,632

* The inventory and growth data contained in this table were developed from the most recent forest survey data available and updated to 1962. The timber cut data were developed from the best available data for 1962. Because of the nature of this compilation the user is advised to keep in mind that they are subject to unquantifiable errors. Thus indicated cuts in excess of growth should be interpreted as meaning that an unfavorable growth-cut relationship may exist in this subbasin.

Cut. The cut of sawtimber in the NAR is about 3.3 billion board feet (Table G-49). It is about evenly divided between hardwoods and softwoods.

About 77 percent of the softwood sawtimber cut is provided by Subregions A, F, and E with 36, 21,and 20 percent respectively. Softwood cut exceeds growth in Subregion E by 181 percent.

Subregion F provides 37 percent of the total Regional hardwood sawtimber cut. The remaining subregional percentages range from 6 to 17 percent.

Production, Employment, Income

The timber resource in the NAR is classified into two major divisions: (1) pulpwood, and (2) sawlogs, veneer logs and miscellaneous timber products.

Pulpwood is the raw material for the Pulp, Paper, and Allied Industries, SIC 26.1/ These industries are the primary consumers of pulpwood and woodpulp for the primary and secondary manufacturing of paper and related products.

Sawlogs, veneer logs, and miscellaneous timber products are the basic constituents for the Lumber and Wood Products Industries, SIC 24.

Pulp, Paper and Allied Industries. Pulpwood production in the NAR in 1962 amounted to 4.9 million cords, (392.0 million cubic feet), (Table G-50). This amounts to approximately 43 percent of the total Regional growing stock cut. The two major areas of production were Subregions A and E with 44 and 30 percent of the Regional production. The remaining Subregions, D, C, B, and E provided 1, 7, 8, and 10 percent respectively.

The production of pulpwood in the Region is expected to triple by 2020. Production is expected to go up in all Subregions except D. Subregional percentage increases to 2020 range from 230 to 446 percent of the base year. Subregions A and F will maintain their leadership with 44 and 22 percent of production respectively. Subregion B is expected to gain about 4 percent of the Regional production by 2020 for a total share of 12 percent. Subregion E will also increase its share from 10 to 14 percent by 2020.

Due to anticipated loss of commercial forest land to other uses, Subregion D is expected to provide only its current rate of 1 percent of total Regional production in 2020.

1/ Standard Industrial Classification.

TABLE G-50

PULPWOOD PRODUCTION BY SUBREGION AND AREA 1962
WITH PROJECTIONS TO 1980, 2000 and 2020
NORTH ATLANTIC REGION

Subregion and Area	River Basin or Area	1962	1980	2000	2020
			thousands cords		
Subregion A					
1	St. John	486.1	512	1,212	1,762
2	Penobscot	557.1	819	1,475	1,837
3	Kennebec	547.8	1,089	1,475	1,562
4	Androscoggin	169.5	255	312	462
5	St. Croix-Atl. Coastal	367.0	631	912	775
Subtotal A		2,127.5	3,306	5,386	6,398
Subregion B					
6	Presumpscot	91.6	132	337	362
7	Merrimack	5.4	30	86	137
8	Connecticut	239.6	500	933	1,300
9	Mass.-RI Atlantic Coast	36.3	10	5	--
10	Thames-Housatonic	30.9	2	1	1
Subtotal B		403.8	674	1,362	1,800
Subregion C					
11	St. Lawrence-Champlain	164.6	378	580	581
12	Hudson	179.3	358	497	455
13	New York City-L.I.	--	--	--	--
Subtotal C		343.9	736	1,077	1,036
Subregion D					
14	Passaic-Raritan	--	--	--	--
15	Delaware	54.9	43	29	17
16	Atlantic Coastal N.J.	15.7	12	5	--
Subtotal D		70.6	55	34	17
Subregion E					
17	Susquehanna	433.7	822	1,365	1,622
18	Chesapeake Bay-Delmarva	76.9	228	432	410
Subtotal E		510.6	1,050	1,797	2,032
Subregion F					
19	Potomac	408.2	806	575	612
20	Rappahannock-York	224.9	411	469	543
21	James	810.5	1,662	2,100	2,162
Subtotal F		1,443.6	2,879	3,144	3,317
TOTAL -N.A.R.		4,900.0	8,700	12,800	14,600

Because of the transfer of semifinished products for further conversion, employment is not restricted to the area of origin of the primary product.

Employment in the pulp, paper, and allied industries amounted to 192,850 in 1962 (Table G-51). Subregions B, D, and C had 28, 27, and 22 percent of the Regional employment. In contrast they had only 8, 1, and 7 percent of the total pulpwood production. Conversely Subregions A and F had 44 and 30 percent of the total pulpwood production but only 7 percent each of total employment.

Regional employment is expected to decrease to 68 percent of the 1962 estimate by the year 2020. Even though overall employment will be reduced, advances in technology and productivity will increase production.

Subregions C, E, and F will increase in their proportionate share of Regional employment by 1980. During this period employment will be 11 percent above the base year.

The year 2000 employment will drop slightly below the base year level. During this time Subregions A, B, and F will increase their Regional share of employment while all others will lose from 1 to 3 percent.

In 2020 Subregions B, D, and C will have 23, 22, and 21 percent of employment respectively. Subregion A will hold level while E and F will lose slightly.

Income in Pulp, Paper, and Allied Industries in 1962 amounted to $1.1 billion (Table G-52). Subregions B, D, and C has 27, 26 and 21 percent respectively of the Regional income. The remaining subregions had between 7 and 11 percent. Income is expected to increase throughout the projected years. By 2020 it is expected to be almost triple base year statistics or around $3.1 billion.

There is expected to be some shifting of income among the Subregions due to production, employment, and technological advances. Subregions B, C, and D will continue to lead the Region although B and D will lose from 4 to 6 percent of their Regional share. This in turn will be picked up by the other Subregions. Subregion B is expected to lose 12 percent of its 1962 Regional share by 1980. It is expected to pick up 6 percent for a share of 21 percent by 2020.

<u>Lumber and Wood Products Industries</u>. (SIC 24) These industries are the primary consumers of sawlogs, veneer logs, and miscellaneous timber products exclusive of pulpwood and fuelwood.

TABLE G-51

EMPLOYMENT IN THE PULP, PAPER AND ALLIED PRODUCTS INDUSTRIES 1/, BY SUBREGION AND AREA, 1962, WITH PROJECTIONS TO 1980, 2000 and 2020
NORTH ATLANTIC REGION

Subregion and Area	River Basin or Area	1962	1980	2000	2020
				Number	
Subregion A					
1	St. John	847	700	1,100	1,000
2	Penobscot	4,680	4,900	6,200	4,800
3	Kennebec	3,794	6,600	9,600	6,600
4	Androscoggin	2,195	2,600	2,800	2,300
5	St. Croix-Atl. Coastal	1,887	2,300	2,700	1,300
Subtotal A		13,403	17,100	22,400	16,000
Subregion B					
6	Presumpscot	2,677	2,700	3,400	1,200
7	Merrimack	8,493	4,800	3,000	11,500
8	Connecticut	15,098	19,900	24,600	15,900
9	Mass.-RI Atl. Coastal	19,008	4,700	1,100	700
10	Thames-Housatonic	8,743	2,700	600	400
Subtotal B		54,019	34,800	32,700	29,700
Subregion C					
11	St. Lawrence-Champlain	4,044	7,800	8,200	5,200
12	Hudson	12,961	23,700	17,200	9,100
13	New York City-L.I.	25,459	23,000	19,600	13,500
Subtotal C		42,464	54,500	45,000	27,800
Subregion D					
14	Passaic-Raritan	25,093	27,200	22,600	16,900
15	Delaware	25,267	20,100	15,200	10,100
16	Atlantic Coastal N.J.	1,752	2,700	3,100	1,800
Subtotal D		52,112	50,000	40,900	28,800
Subregion E					
17	Susquehanna	10,380	17,800	17,700	10,600
18	Chesapeake Bay-Delmarva	6,952	18,400	10,000	4,700
Subtotal E		17,332	36,200	27,700	15,300
Subregion F					
19	Potomac	3,524	5,100	5,500	3,100
20	Rappahannock-York	636	900	800	600
21	James	9,090	14,900	15,000	9,400
Subtotal F		13,250	20,900	21,300	13,100
TOTAL - N.A.R.		192,580	213,500	190,000	130,700

Note: Projections of employment were based on the pulpwood input figures shown in a preceeding table and the assumption that productivity, i.e., the volume of wood processed by each employee, would continue to increase at historical rates. Implicit in this rate is an allowance for an increase in secondary manufacturing activities such as the further manufacture of paper and board into bags, boxes, and other similar products.

1/ Major group SIC 26.

TABLE G-52

INCOME (WAGES AND SALARIES) IN THE PULP, PAPER, AND ALLIED PRODUCTS INDUSTRIES 1/, BY SUBREGION AND AREA, 1962, WITH PROJECTIONS IN 1980 2000 and 2020
NORTH ATLANTIC REGION

Subregion and Area	River Basin or Area	1962	1980	2000	2020
			Thousand Dollars		
Subregion A					
1	St. John	5,001	6,000	16,200	24,400
2	Penobscot	28,293	44,400	90,500	119,600
3	Kennebec	21,674	58,100	130,000	155,200
4	Androscoggin	13,059	22,900	39,200	54,700
5	St. Croix-Atl. Coastal	11,425	21,300	38,400	30,900
Subtotal A		79,452	152,700	314,300	384,800
Subregion B					
6	Presumpscot	15,899	24,200	49,400	28,700
7	Merrimack	45,074	38,200	40,300	219,400
8	Connecticut	84,317	158,600	334,600	380,200
9	Mass.-RI Atl. Coastal	100,308	38,000	14,000	15,500
10	Thames-Housatonic	47,408	22,200	7,700	9,300
Subtotal B		293,006	281,200	446,000	653,100
Subregion C					
11	St. Lawrence-Champlain	23,285	71,300	112,700	125,200
12	Hudson	75,019	218,400	261,100	226,900
13	New York City-L.I.	134,401	199,000	262,200	314,600
Subtotal C		232,705	488,700	636,000	666,700
Subregion D					
14	Passaic-Raritan	137,723	235,500	303,100	396,200
15	Delaware	138,904	180,400	210,600	247,000
16	Atlantic Coastal, N.J.	9,261	26,100	42,200	41,400
Subtotal D		285,888	442,000	555,900	684,600
Subregion E					
17	Susquehanna	82,363	163,600	252,100	264,300
18	Chesapeake Bay-Delmarva	37,313	160,800	136,300	117,100
Subtotal E		119,676	324,400	388,400	381,400
Subregion F					
19	Potomac	19,620	45,300	74,100	80,100
20	Rappahannock-York	4,030	8,700	119,600	14,500
21	James	52,923	137,900	208,400	225,600
Subtotal F		76,573	191,900	402,100	320,200
TOTAL - N.A.R.		1,087,300	1,880,900	2,742,700	3,090,800

Note: Projections of payrolls were based on the employment figures shown in a preceding table and the assumption that average wages and salaries per employee would increase at the same rate as productivity.

1/ SIC 26.

Sawlog production in the Region in 1962 amounted to 390.0 million cubic feet (Table G-53). This is approximately 43 percent of the total Regional growing stock cut. The remaining 57 percent of growing stock cut is composed of pulpwood, fuelwood, and miscellaneous timber products.

Subregions F and C provided 27 and 20 percent of the total Regional production. The remaining subregions provided between 9 and 17 percent.

Subregion B will gain 5 percent by 2020. Both Subregions C and D will lose production due to reduction in sawlog inventory and loss of commercial forest land to other uses.

Subregion E will gain 6 percent of Regional production to 2000 then decline slightly to 2020. Subregion F, while accounting for 27 percent of the 1962 Regional production, will drop to 18 percent by 2020.

Employment in the Region in 1962 in these industries amounted to 70,690 (Table G-54). Subregions F and B had 21 percent each of the Regional employment; 16 percent each in A and C and 14 and 12 percent in E and D respectively.

Employment in these industries is somewhat more consistent with the area of production of the primary product than is found in the pulp and paper industry. For example, Subregion F had 27 percent of the production and 21 percent of the employment in 1962. The other subregions had variances between production and employment of from 1 to 4 percent.

By 2020 employment is expected to drop to 54 percent of the 1962 estimate. It is expected that a reduction of approximately 20 percent will occur in each of the time frames 1980-2000 and 2000-2020.

Subregions A, D, and E will lose 6, 6, and 2 percent, while Subregions B, F, and C will gain percentage shares of 8, 5, and 1 of Regional employment by 2020.

Income (salaries and wages) in the Lumber and Wood Products Industries in the Region amounted to $258.3 million in 1962 (Table G-55). It is expected to increase throughout the projection periods to $438.8 million by 2020. This is a 170 percent increase of 1962 estimates.

Percentage distribution of Regional income follows the same trend as the employment statistics from which it was derived. This also holds true for the projection years.

Forest Management. This field of employment consists of those engaged in the protection and management of forests for the

TABLE G-53

PRODUCTION OF SAWLONGS, VENEER LOGS, AND MISCELLANEOUS INDUSTRIAL TIMBER PRODUCTS 1/, BY SUBREGION AND AREA, 1962 WITH PROJECTIONS TO 1980, 2000, and 2020
NORTH ATLANTIC REGION

Subregion And Area	River Basin Or Area	1962	1980	2000	2020
		million cubic feet			
Subregion A					
1	St. John	7.8	20	18	7
2	Penobscot	13.4	31	38	17
3	Kennebec	11.9	17	10	7
4	Androscoggin	6.2	15	25	15
5	St. Croix-Atl. Coastal	7.1	26	39	62
Subtotal A		46.4	109	130	108
Subregion B					
6	Presumpscot	7.9	16	39	43
7	Merrimack	5.9	8	13	27
8	Connecticut	31.7	33	38	67
9	Mass.-R.I. Atl. Coastal	7.2	6	8	7
10	Thames-Housatonic	12.6	9	10	11
Subtotal B		65.3	72	108	155
Subregion C					
11	St. Lawrence-Champlain	17.9	41	53	74
12	Hudson	24.6	33	42	45
13	New York City-L.I.	37.0	--	--	--
Subtotal C		79.5	74	95	119
Subregion D					
14	Passaic-Raritan	7.9	6	--	--
15	Delaware	24.4	32	36	43
16	Atlantic Coastal N.J.	1.7	--	--	--
Subtotal D		34.0	38	36	43
Subregion E					
17	Susquehanna	43.2	67	95	100
18	Chesapeake Bay-Delmarva	14.3	24	30	35
Subtotal E		57.5	91	125	135
Subregion F					
19	Potomac	31.9	48	58	82
20	Rappahannock-York	24.9	29	23	24
21	James	50.5	39	25	14
Subtotal F		107.3	116	106	120
Total N.A.R.		390.0	500	600	680

1/ Raw material for SIC 24.

TABLE G-54

EMPLOYMENT IN THE LUMBER AND WOOD PRODUCTS INDUSTRIES 1/, BY SUBREGION AND AREA. 1962, WITH PROJECTIONS TO 1980, 2000 and 2020
NORTH ATLANTIC REGION

Subregion and Area	River Basin or Area	1962	1980	2000	2020
		Number			
Subregion A					
1	St. John	1,244	1,300	700	200
2	Penobscot	2,566	2,400	1,500	500
3	Kennebec	3,471	2,600	600	300
4	Androscoggin	2,347	2,200	1,500	800
5	St. Croix-Atl. Coastal	1,315	1,800	1,700	1,900
Subtotal A		10,943	10,300	6,000	3,700
Subregion B					
6	Presumpscot	2,036	1,900	2,400	1,600
7	Merrimack	1,810	1,700	1,100	500
8	Connecticut	5,245	3,900	1,800	4,300
9	Mass.-RI Atl. Coastal	4,538	4,200	4,400	1,600
10	Thames-Housatonic	1,449	1,600	4,300	3,000
Subtotal B		15,078	13,300	14,000	11,000
Subregion C					
11	St. Lawrence-Champlain	2,382	3,600	4,200	3,100
12	Hudson	2,269	3,200	2,800	1,900
13	New York City-L.I.	6,476	5,400	2,900	1,400
Subtotal C		11,127	12,200	9,900	6,400
Subregion D					
14	Passaic-Raritan	3,202	2,800	1,200	400
15	Delaware	4,927	5,100	2,900	1,800
16	Atlantic Coastal, N.J.	558	400	200	100
Subtotal D		8,687	8,300	4,300	2,300
Subregion E					
17	Susquehanna	6,136	6,000	3,600	2,700
18	Chesapeake Bay-Delmarva	3,549	3,400	2,400	1,800
Subtotal E		9,685	9,400	6,000	4,500
Subregion F					
19	Potomac	4,241	4,500	7,400	8,600
20	Rappahannock-York	3,020	2,400	1,300	1,000
21	James	7,727	5,000	1,400	600
Subtotal F		15,170	11,900	10,100	10,200
TOTAL - N.A.R.		70,690	65,400	50,300	38,100

Note: Projections of employment were based on the timber input figures shown in a preceeding table and the assumption that productivity, i.e., the volume of wood processed by each employee, would continue to increase at historical rates. Implicit in this rate is an allowance for an increase in secondary manufacturing activities such as the further manufacture of lumber into millwork, and prefabricated buildings.
1/, Major group SIC 24.

TABLE G-55

INCOME (WAGES AND SALARIES) IN THE LUMBER AND WOOD PRODUCTS INDUSTRIES 1/
BY SUBREGION AND AREA, 1962 WITH PROJECTIONS TO 1980, 2000 and 2020
NORTH ATLANTIC REGION

Subregion and Area	River Basin or Area	1962	1980	2000	2020
		Thousand Dollars			
Subregion A					
1	St. John	4,432	5,500	5,200	1,800
2	Penobscot	9,122	10,800	10,600	5,000
3	Kennebec	12,837	12,200	4,500	3,000
4	Androscoggin	8,679	10,500	11,400	9,400
5	St. Croix-Atl. Coastal	4,626	7,800	12,800	20,100
Subtotal A		39,606	46,800	44,500	39,300
Subregion B					
6	Presumpscot	7,440	8,800	18,200	17,600
7	Merrimack	6,829	8,000	9,100	5,400
8	Connecticut	19,266	18,000	13,600	46,100
9	Mass.-RI Atl. Coastal	17,214	20,100	34,800	18,300
10	Thames-Housatonic	5,371	7,400	33,800	33,800
Subtotal B		56,120	62,300	109,500	121,200
Subregion C					
11	St. Lawrence-Champlain	8,444	16,200	31,700	40,300
12	Hudson	8,289	14,900	21,900	20,500
13	New York City-L.I.	27,067	28,200	25,400	17,900
Subtotal C		43,800	59,300	79,000	78,700
Subregion D					
14	Passaic-Raritan	13,027	14,600	10,200	5,500
15	Delaware	19,167	24,900	23,600	20,400
16	Atlantic Coastal N.J.	2,231	2,200	2,100	1,000
Subtotal D		34,515	41,700	35,900	26,900
Subregion E					
17	Susquehanna	22,596	27,700	26,000	28,100
18	Chesapeake Bay-Delmarva	13,785	18,600	19,000	21,100
Subtotal E		36,381	46,300	45,000	49,200
Subregion F					
19	Potomac	15,844	38,000	60,800	104,200
20	Rappahannock-York	8,802	16,700	7,600	12,600
21	James	23,212	30,000	8,100	6,700
Subtotal F		47,858	84,700	76,500	123,500
TOTAL N.A.R.		258,280	341,000	390,400	438,800

1/ SIC 24

Note: Projections of payrolls were based on the employment figures shown in a preceding table and the assumption that average wages and salaries per employee would increase at the same rate as productivity.

production of timber and related products. In 1962 employment in the Region was estimated to be 11,900 (Table G-56).

Subregions F and A lead the Region with 26 and 21 percent of employment. The other subregions had between 8 and 17 percent of Regional employment.

Employment is expected to increase throughout the projection period to around 266 percent of the base year statistics by 2020. This increase will be brought about by a greater demand for wood products and an enlightened public concern for natural resource protection and management.

Income is expected to increase throughout the projection years from $59.5 million in 1962 to $661.3 million by 2020 (Table G-57).

Water Resources

The value of the forest resource in providing clear, clean, potable water should not be underestimated. The forested area of the Region comprises the largest catchment area for precipitation. It serves as a great storage reservoir and filtering agent between the primary source of supply and storage areas downstream. The quality of this water has a direct economic relationship to the price of the end product. Well managed and protected forest watersheds contribute relatively small amounts of sediment to downstream channels (Appendix Q - Sediment and Erosion).

Forests directly affect the flow of streams by lessening the quantity and velocity of water moving over the land surface. A portion of the precipitation, intercepted by the vegetation, is lost by evaporation; the remaining portion falls to the earth's surface. Trees, shrubs, other vegetation, and ground litter act as mechanical checks on the impact of precipitation on the soil. Ground litter and humus also absorb and hold limited amounts of moisture allowing it to percolate slowly through the soil profile to ground storage. This ground water particularly from the deeper soils, provides recharge and base flow to streams, lakes and rivers of the Region.

It was upon this very principle that National Forests were extended east of the Mississippi River under the authority of the Weeks Act of 1911 and the Clarke-McNary Act of 1924. These Acts authorized and directed the Secretary of Agriculture to recommend for purchase such forested, cutover, or denuded lands within the watersheds of navigable streams as in his judgment may be necessary for the regulation of the flow of navigable streams or for the production of timber.

These forests are managed under the principle of multiple use for the production of wood, water, wildlife, recreation and forage.

TABLE G-56

EMPLOYMENT IN FOREST MANAGEMENT 1/,
BY SUBREGION AND AREA, 1962 WITH
PROJECTIONS TO 1980, 2000 and 2020
NORTH ATLANTIC REGION

Subregion and Area	River Basin or Area	1962	1980	2000	2020
			Number		
Subregion A					
1	St. John	491	600	1,100	1,400
2	Penobscot	750	1,100	1,700	2,000
3	Kennebec	556	900	1,400	1,800
4	Androscoggin	213	300	500	500
5	St. Croix-Atl. Coastal	424	700	1,000	1,200
Subtotal A		2,434	3,600	5,700	6,900
Subregion B					
6	Presumpscot	365	500	900	1,000
7	Merrimack	293	400	600	800
8	Connecticut	850	1,200	1,700	2,300
9	Mass.-R.I. Atl. Coastal	221	300	400	400
10	Thames-Housatonic	351	400	600	800
Subtotal B		2,080	2,800	4,200	5,300
Subregion C					
11	St. Lawrence-Champlain	704	1,100	1,700	2,200
12	Hudson	762	1,100	1,600	2,000
13	New York City-L.I.	238	200	300	400
Subtotal C		1,704	2,400	3,600	4,600
Subregion D					
14	Passaic-Raritan	145	200	200	200
15	Delaware	747	1,100	1,500	1,900
16	Atlantic Coastal, N.J.	75	100	100	100
Subtotal D		967	1,400	1,800	2,200
Subregion E					
17	Susquehanna	1,305	2,000	3,100	3,900
18	Chesapeake Bay-Delmarva	276	500	700	800
Subtotal E		1,581	2,500	3,800	4,700
Subregion F					
19	Potomac River	1,653	2,300	3,400	4,500
20	Rappahannock-York	417	500	700	900
21	James	1,064	1,500	2,100	2,500
Subtotal F		3,134	4,300	6,200	7,900
Total-N.A.R.		11,900	17,000	25,300	31,600

1/, The protection and management of forests for the production of timber and related products.

TABLE G-57

INCOME (WAGES AND SALARIES) IN FOREST MANAGEMENT
BY SUBREGION AND AREA, 1962, WITH PROJECTIONS TO
1980, 2000 and 2020 1/
NORTH ATLANTIC REGION

Subregion and Area	River Basin or Area	1962	1980	2000	2020
		Thousand Dollars			
Subregion A					
1	St. John	2,457	4,900	13,500	28,800
2	Penobscot	3,749	8,300	21,100	41,300
3	Kennebec	2,779	6,800	17,800	37,700
4	Androscoggin	1,065	2,500	5,800	11,400
5	St. Croix-Atl.Coastal	2,118	5,100	12,700	24,500
Subtotal A		12,168	27,600	70,900	143,700
Subregion B					
6	Presumpscot	1,827	4,000	11,100	21,000
7	Merrimack	1,464	3,200	7,800	17,200
8	Connecticut	4,248	9,000	22,300	48,300
9	Mass.-R.I. Atl.Coastal	1,107	2,200	5,000	9,200
10	Thames-Housatonic	1,755	3,400	8,000	15,700
Subtotal B		10,401	21,800	54,200	111,400
Subregion C					
11	St.Lawrence-Champlain	3,522	8,700	21,200	45,700
12	Hudson	3,808	8,700	20,800	42,300
13	New York City-L.I.	1,190	1,800	4,200	8,100
Subtotal C		8,520	19,200	46,200	96,100
Subregion D					
14	Passaic-Raritan	726	1,400	2,600	4,600
15	Delaware	3,737	8,300	19,800	39,100
16	Atlantic Coastal N.J.	375	700	1,600	2,900
Subtotal D		4,838	10,400	24,000	46,600
Subregion E					
17	Susquehanna	6,527	15,500	39,300	80,900
18	Chesapeake Bay-Delmarva	1,380	3,600	8,700	17,200
Subtotal E		7,907	19,100	48,000	98,100
Subregion F					
19	Potomac	8,265	18,300	43,800	94,600
20	Rappahannock-York	2,082	4,200	9,300	18,400
21	James	5,319	11,900	26,700	52,400
Subtotal F		15,666	34,400	79,800	165,400
TOTAL N.A.R.		59,500	132,500	323,100	661,300

1/ The protection and management of forests for the production of timber and related products.

Water resource development is an integral part of the overall water and related land resource development plan of the National Forests.

The 1.8 million acres of forested watershed lands of the National Forests provide water for over 30 towns and numerous individual local users. Ground water is virtually untapped. In all National Forest areas municipal and industrial water supply potential exists. Some development constraints are low flows and mineral composition.

Appendix F Upstream Flood Prevention and Water Management summarizes the existing potential storage areas.

In addition to National Forest lands there are approximately 2.0 million acres of forest land utilized as municipal watersheds.(11) Based on watershed acreage 41 percent is under municipal control, 13 percent private, and the remaining 46 percent is owned by federal or state governments. From a numerical standpoint 480 (64 percent) watersheds are owned by municipalities, 120 (16 percent) are in private ownership, 112 (15 percent) are owned by state governments and 38 (5 percent) are in federal ownership.

Natural water production in the NAR averages about one million gallons per day from each square mile of land surface. This yield varies considerably from north to south, with the area north of the Delaware River Basin averaging 1.0 to 1.1 million gallons per square mile and the average southward from 0.9 to 0.6 million gallons.

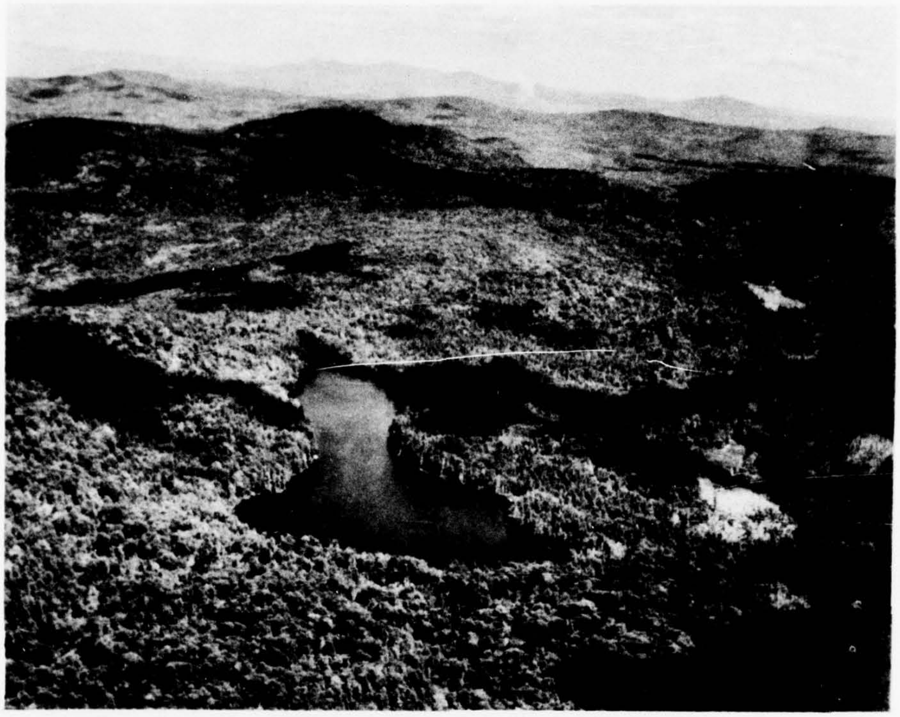
The annual dependable flow for the NAR is about 0.65 million gallons per square mile. This represents just under 69 percent of the average annual yield. The timing of these yields is not satisfactory for our complex urban industrial civilization in this area without a considerable storage facility. Much of this storage facility is in place, but recent droughts have indicated weak points where improvement is needed. Future demands may necessitate more storage capacity.

The extensive and well distributed forests of the Region offer, in certain localized situations and selected areas, possibilities for management to increase water supplies through manipulation of forest cover. An efficient program for increasing water yields in this manner depends on provision of sufficient reservoir storage to contain the increase, on provisions to protect aesthetic and other forest values, and on sufficient ground cover to protect the site. In addition, basic safeguards in location, use and maintenance of roads and skid trails must be observed.

It should be noted, however, that the maximum production from the 2 million acres of municipally owned watersheds, if placed under intensive management, falls considerably short of meeting the goal of satisfying the consumptive needs by the year 2020. Yield from

Hiking in the White Mountain National Forest, New Hampshire

Sherando Recreation Area on the George Washington National Forest, South Fork Shenandoah River, Virginia



Griffith Lake, Green Mountain, National Forest, Vermont

Natural reproduction in a stand selectively
cut 8 years earlier, Harpswell, Maine

additional watershed area would be needed to add to those areas which may be placed under intensive management to provide the remainder of the consumptive use. With multiple use management of the municipal watersheds, yield from an additional 17 million acres of forest land would be necessary to meet total consumptive uses by 2020. Yield from about 10 million acres would be needed to satisfy the increased consumption of water in the same time period. Should maximum water yields be established on the municipal lands more of the total demand could be met. Less additional watershed land would be needed to satisfy the remaining needs.

Other demands of land management besides water are or will be important in many forested municipal watersheds. The production of timber products, wildlife, fish and various forms of recreation are expected to be in increasing demand as the population base increases. Growth of timber on municipal watersheds, other than that in federal ownership, is estimated at 160 million board feet annually. The potential dollar yield of this volume each year is over 1 million dollars.

Outdoor recreation is also increasing on municipal watersheds. Recent surveys indicate that between 35 and 40 percent of the managers of these properties allow some hunting, hiking and fishing. To a lesser extent (10 to 20 percent) picnicking, horseback riding and boating are tolerated. All other uses are infrequent. In a national survey it was found that only 32 percent of municipal reservoir managers allowed any activity and of this only 42 percent allowed any body contact. (26)

Recreation in municipal water systems is presented more fully in Appendix M - Recreation, developed by the Bureau of Outdoor Recreation (BOR).

Water quality control is a major issue with most watershed managers. This particular item is often interlocked with other uses and must be discussed from this viewpoint. Since few municipal watershed lands cover the whole natural drainage involved, contamination can and often does come from property not in the control of management. Where the use of the municipal watershed involves activities such as recreation, logging, water yield improvement, etc., there is also an opportunity for contamination of waters from within the ownership. The major sources of either type of contamination have been listed by managers as effluent from domestic and recreational sources, water quality impairment by logging activities, and problems with water color, taste and odor from algae, swamp drainage, or farmland runoff. Mention of winter salting, birds and animal waste has also been common.

The municipal water problems for the Region center about quality and storage. Northern New England suffers from pollution in some of the lower reaches of the main rivers. To some extent the municipal supplies from these rivers could be replaced with

forested upland watersheds. This would augment a poor quality supply with a high grade product and reduce the demand on the lower river supplies.

Fish and Wildlife Resources

The forests provide the largest single type of wildlife habitat. They provide food and shelter for a variety of forest-game animals: moose, deer, bear, snowshoe hare, gray squirrel, raccoon, woodcock, ruffed grouse, and turkey and satisfy a portion of the requirements of other species. They are also the home of many nongame species and lesser creatures. Waterfowl are also frequent visitors to the forest environment utilizing beaver flowages, natural waterways and flooded green ponds for nesting and resting areas on their biannual migrations.

The economic impact of the wildlife resource is tremendous. In 1965 approximately 2.8 million hunters spent approximately 37 million man-days in pursuit of small and big game. An additional 60 million man-days were spent in nonconsumptive uses, wildlife photography, bird watching and nature walks.

Small and big game hunters spent an average of approximately $7 per day or a total expenditure of $240 million. A large percent of the total man-days was spent in the forest environment which constitutes the main small and big game habitat.

Not only do forests provide habitat for game and nongame species, they also influence the fresh water fishery resource. A supply of cool, clear water is a necessity for the natural propagation and survival of our cold-water fishes. The economic importance of the fresh water fishery resource is illustrated by the fact that in 1965 an estimated 3.1 million fishermen spent 56.7 million fishing-days or an average of 18 days each within the Region.

In the shell fish and estuarine fishery the forest resource plays an important part in the control of erosion and sedimentation. The estuaries provide the juvenile habitat for nearly 70 percent of the fishes of the Atlantic shelf and constitute the resident habitat of many shellfish.

A recent appraisal by the U. S. Geological Survey (12) illustrates the relationship between downstream sediment deposition and upstream land use. The report indicates a direct inverse relationship between sediment deposition and the percentage of forest land in upstream watersheds. Heavily forested areas contributed the least amount of sediment in comparison to other land uses.

The economic implications of sedimentation are not limited to the fishery resource alone but also encompasses the deterioration

of waterfowl habitat and the dredging of navigation channels and boat docking facilities. In each situation the maintenance of forest cover in upstream watersheds constitutes a direct economic benefit to downstream areas. For further information on Fish and Wildlife Resources see Appendix O prepared by the Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, USDI

Recreation Resources

The forest environment provides a spirit of adventure and aesthetic quality for the recreation experience. The demand for forest related outdoor recreation has generally exceeded the developed supply of the public and private sector. In general, the forest environment provides the major base for future development of federal, state and private recreation facilities in the Region.

In 1963, federal agencies had a total of 49 developed camping and picnic areas with approximately 2,790 sites. National Forests in and immediately adjacent to the Region are within a radius of 225 miles of the major metropolitan centers and urban populations. These developments are within an area of federal ownership totaling around 3 million acres and provide a variety of year-round recreation experiences.

State, county, city, and civic agencies had a total of 253 areas providing 21,676 sites. Total acreage amounts to around 1.2 million acres. Most of this acreage is in state ownership. However, only a portion of the total acreage is allocated to recreation development.

Private campground enterprises totaled 781 acres. These areas provided 45,488 sites on 85 thousand acres or approximately 1.9 acres per site (1963 base year). The private sector offers the greatest potential in providing campground opportunities to the public because of the preponderance of area in private ownership. The foregoing has emphasized use of developed recreation areas. One recreational feature that stretches almost the entire length of the Region is the Appalachian Trail, with Mt. Katahdin in Maine its northern terminus. Forested areas, both private and public, provide widespread attraction for more dispersed recreation, including but not limited to hunting, fishing, camping, hiking, berrying, canoeing, mushroom picking, nature study and many other related pursuits.

For further dissertation on recreation and potential development see Appendix M - Recreation, prepared by the Bureau of Outdoor Recreation, U.S. Department of the Interior.

Environmental Quality

Collectively the forested areas of the Region provide a pleasing and sylvan characteristic. The interspersion and juxtaposition of surface water, farmland, villages, forested mountains and valleys

all contribute to the quality of the landscape. Each spring and fall thousands of tourists visit areas of vegetal coloration to view their spectacular beauty. In some areas forest cover can also contribute to monotony. Too much of any one type of landscape whether it be forest, farmland or urban reduces the aesthetic quality of the total environment. The role forests play in enrichment of the environment is emphasized in the development of the Environmental Quality objective in the Region's overall planning.

A study of Visual and Cultural Environment (13) was prepared by Research Planning and Design Associates, Incorporated, for the NAR Coordinating Committee. The distribution pattern is highly important and provides a basis for describing landscape units. Five basic landscape units are described for the Region. These consist of the following: Town/Farm, Farm, Farm/Forest, Forest/Town and Forest/Wildland landscape units. Forest acreage, while not the generator of the dominant image in all these units, is an important element contributing to the richness and diversity of pattern.

Visual quality is not limited to the gross components of the landscape. The individual tree, flower and bird also delight the eye, and visual quality is of course only one element of many involved in determining the quality of our environment. The purity of the air we breathe, the scents that reach us, the water we drink, cook or bathe with, the sounds we hear, the ground we tread, the temperatures we feel, and the texture of the materials and objects we touch, on all of these too the effect of trees and forested areas is positive and beneficent.

In summary, the forest lands contribute to the economy and well-being of the Region by providing goods and services to the people in the form of employment and income, forest products, water, wildlife, recreation, and enhancement of the environment.

LAND MANAGEMENT PROBLEMS AND NEEDS

The combined efforts of long range planning and control regulations by the responsible units of government are essential if man is to control his natural environment. Quality of the environment with emphasis on open space and recreational amenities will contribute greatly to the life styles of future urban and suburban living.

Our sprawling metropolitan areas present a challenge. Beyond the core of cities are vast areas where new cities are yet to be built and in these areas there is still an opportunity to make land use decisions to determine if man can live in harmony with nature or will continue to destroy it.

<u>Flooding</u>. Floods disrupt households, hamper business, post health problems, hinder transportation, mar the landscape, and

cause loss of life. The extent of flooding is significant and will be an even greater problem in the future.

Present average annual damage in upstream areas outside of watershed projects is $50.8 million. If no additional flood prevention measures were installed, the present average annual flood damages of $55 million would increase to $277 million in 2020.

Erosion and Sedimentation. Land use in the NAR is changing rapidly. Land in farms will be reduced by more than one-half by 2020. While forest land will remain stable, urban land will show an increase of nearly 150 percent by 2020 and Other land will almost double their present amounts.

Rates of erosion are expected to increase steadily. In addition to erosion from cropland and pasture, expected land use shifts to urban land will tend to increase the erosion rate.

When the land is undergoing urban development the construction operations expose the soil and subject the land to severe erosion which results in excessive sedimentation. The erosion continues from the time of removal of natural cover until restabilization is completed. The rate of erosion is vastly greater than the amount eroded from farms and forests in an equivalent period of time. A number of factors affect the rate of erosion from construction operations during urbanization.

The extent to which natural vegetative cover is removed.
The time between removal of natural cover and restabilization by paving, seeding, sodding, landscaping, etc.
The nature of the affected soils and the length and degree of slope.
The size of the development and its proximity to natural stream channels.
Construction location, including layout of streets, sidewalks, gutters, etc.
Climatic factors, including the intensity and duration of rainfall, freezing and thawing, temperature and the seasonal establishment of temporary and permanent vegetation.

Water Quality. Major agricultural pollutants in upstream areas that affect water quality are sediment, animal and food processing wastes, plant nutrients, chemical exotics and infectious agents. Other problem areas include sanitary landfill and strip mines.

Agricultural pollutants are rarely discharged directly into streams. They originate or are spread on the land surface. Transporters of these pollutants are water, wind, animals, and mechanical devices. The major portion of agricultural pollutants reach the streams through runoff.

The Appalachian Regional Commission in cooperation with the National Academy of Science and National Academy of Engineering completed a one year study in 1969 to determine the effects of acid mine drainage pollution on economic development in the Appalachian Region. Three-fourths of the acid streams were found to be in the Susquehanna, Potomac, Delaware, Allegheny and Monongahela River Basins in Pennsylvania, Maryland, and West Virginia. The study found that over 70 percent of the acid mine drainage originates in underground mines and nearly all of the acid mine drainage from inactive coal-producing mines originates in underground operations. The study concludes that no single technique or approach can be used to abate or control mine acid drainage effectively. Most abatement techniques are expensive. Those that are relatively inexpensive include land reclamation and drainage diversion. Since only 12 percent of acid drainage comes from surface sources, these techniques cannot be expected to eliminate very much of the problem.

Sediment. The single most important pollutant in terms of volume of streams is sediment. It affects public health, municipal and industrial water supply, valley agriculture, drainage, irrigation, flood control, navigation, fish and wildlife, recreation, electric power production, and road and highway maintenance. In the NAR, sheet erosion on cultivated land and on land undergoing urban development is usually the source of the sediment that causes most downstream damage. Of the 14 million cubic yards of sediment reaching the major river in the NAR annually, an estimated 56 percent comes from crop, pasture, and forest land, and 44 percent from Other and Urban lands.

Animal Wastes. At one time, animal wastes were considered an asset providing fertility to the soil. More recently, animal wastes are considered by many to be the most fearsome agricultural wastes. The changes in view toward manure have occurred because livestock and poultry production is becoming concentrated in large scale, confinement-type enterprises. Such concentrations have greatly magnified the problems of handling wastes, health hazards, and aesthetic nuisances.

Processing Industries Wastes. Oxygen demanding wastes from processing agricultural and forestry products include runoff or effluent from woodpulp, paper and fiberboard manufacturing; fruit and vegetable canning; cleaning dairy plant tanks and other equipment; slaughtering and processing of meat animals, and tanning; manufacturing cornstarch and soy protein; sugar refining; malting, fermenting and distilling; scouring wool and wet processing in textile mills.

Plant Nutrients. Fertilizers have made it possible to produce more crops on less acreage. Fertilizers are an integral part of intensified agriculture; they must also be regarded as a potential

source of water pollution. Plant nutrients removed on sediment, in runoff water, and by leaching may produce two pollution problems: (a) accelerated eutrophication of surface waters, and (b) ground water contamination.

Chemical Exotics. Chemical exotics such as detergents and pesticides are contaminants of our environment. Phosphates found in detergents cause algae to grow unusually fast. Excess algae in our water bodies cause many problems.

Pesticides by nature are poisonous. They include herbicides, growth regulators, acaricides, insecticides, fumigants, nematicides, and rodenticides.

Infectious Agents. Bacteria, fungi, and viruses are infectious agents that cause disease in or on plants, animals, and humans. When transmittal of the agent is uncontrolled, serious outbreaks of disease can occur.

Sanitary Landfill. One of the major problems in the urban areas of the NAR is the disposal of solid waste. Refuse disposal must be accomplished on the land because legal constraints usually restrict dumping of refuse in bodies of water. In many urban areas the process of incineration is used. The burning of wastes is only a reduction process and the residues and unburnable matter must be disposed of on the land. The process of solid waste disposal most widely accepted is controlled sanitary landfill.

Sanitary landfill is a method of covering compacted refuse with a layer of earth without creating nuisances or hazards to public health or safety.

The present per capita amount of waste and refuse is about 5 pounds per day. This is equivalent to 7 acre feet of land use space needed per 7,000 people per year. Current rates are expected to increase to 10 pounds per capita per day by the year 2000.

Strip Mining. There are over 500,000 acres of surface mined land needing treatment in the states which comprise the NAR according to data supplied by the U. S. Department of the Interior, the Soil Conservation Service, and from study group estimates.

Seven minerals accounted for 95 percent of the acreage disturbed by surface mining. Coal constitutes 40 percent of the total acreage followed by sand and gravel with 25 percent. Stone, gold, clay, phosphate, and iron made up the remaining 30 percent.

Abandoned surface mines are usually unattractive areas that are void of vegetation and subject to severe erosion. Sediment from eroded areas pollute streams. In addition, acid in the exposed soil may further contaminate streams with chemicals.

Watershed Yield. The water resource is abundant in the NAR when the average availability of water is considered. Precipitation is fairly evenly distributed throughout the year, but runoff exhibits considerable seasonal and geographical variations. More than one-half of the annual runoff (yield) often occurs in two or three spring months.

The runoff portion of precipitation is much lower in the southern part of the Region than the northern. This is due largely to the longer growing season which results in large evapotranspiration rates exhausting most of the normal summer rainfall.

Forest Management and Development. Perhaps the single most significant forest land problem is the fragmented ownership of the 47.7 million acres of privately owned nonindustrial commercial forest land among an estimated 867,000 owners averaging 55 acres each. Less than 2 percent of these owners have utilized available technical assistance in the management of their forest resources.

Correspondingly, less than 10 percent of the area which is harvested for wood products from these ownerships receives protection from overcutting. Many forest stands are of small size, poorly stocked, and consist of undesirable species, and defective, poorly formed and low quality trees. Insects and disease kill over 66 million cubic feet annually.1/

Forest fires are an annual threat. The average area burned annually in the Region is 78,100 acres. A more serious problem is the exceptional year when severe conditions result in a much larger area burned. It is not economically feasible for each state to staff and equip a control organization to meet the needs of exceptional conditions. Risk is continually increasing due to the increasing population, increasing use of forested area, proliferation of summer homes of an affluent society, and related factors. Forest soil structure may be damaged by moderate to severe burning. Where such damage does occur, recovery is often slow, with poor hydrologic conditions as a possible result.

Grazing of about 3.8 million acres of forest land by domestic animals destroys ground litter and tree reproduction, compacts the soil, damages hydrologic condition and accelerates runoff and erosion. This, together with other disturbance factors such as fire and poor logging practices, have resulted in accelerated erosion now occurring on about 153,000 acres. This erosion reduces

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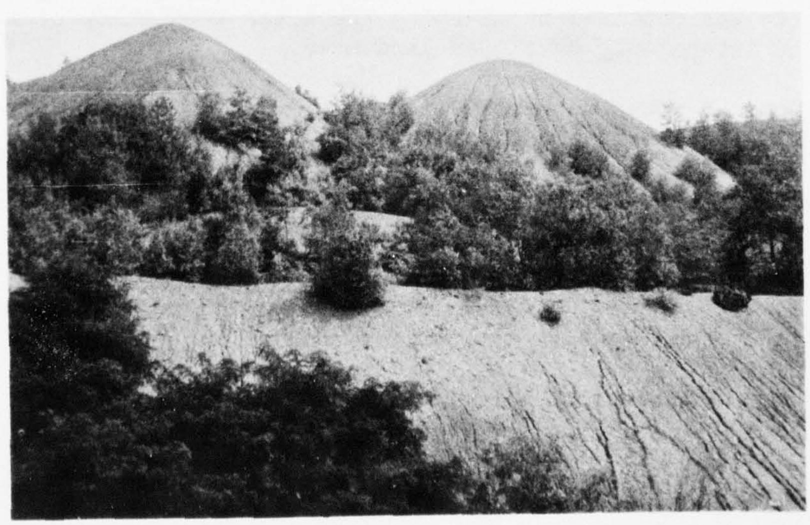
1/ USDA, Forest Service, Timber Trends in the United States, Forest Resource Report No. 17, 1965.

the potential growth capacity and hydrologic condition, damages fish habitat, and lowers water and overall environmental quality.

For many of the above described problems, the need for action is obvious, such as the need to control grazing and erosion on the acreages noted above. Certain other needs have been quantified. Trees should be planted on 5.4 million acres; this area includes both open land better suited to forest than to other crops, and forest land which is poorly stocked or stocked with undesirable species. The area needing improvement of existing stands amounts to 20.3 million acres. Improved timber harvesting techniques are needed on over half a million acres which are cut annually. There is a need to reduce the losses due to fire, insects and disease, in order to meet projected demands for timber and make a larger contribution to the economy of the Region. There is a need to develop an effective transportation system on public lands to facilitate management. Perhaps most of all, there is a need to make the great majority of private landowners aware of the values - private and public - of their forest resources, and convince them that most of these resources should be managed for their personal objectives and for the public good.

Deteriorated Environment

This is a problem which has received widespread recognition in the last few years. Because of the concentration of population and industry, it is probably more acute in the NAR than in any other region of comparable size in the nation. Many aspects have already been discussed in the previous pages: erosion, sedimentation, water quality, pesticides, solid waste, and strip mining. There are many others. One is the loss of open space in urban and urbanizing areas, and the deterioration of the vegetal cover which has been incorporated in built-up areas.



Piles of coal wastes are high contributors of sediment.

URBAN LAND NEEDS

Introduction

In 1969, the RPA completed a study of present and projected urban development and land use in the NAR. The land demand projections were based on three differing sets of assumptions with respect to a most likely, a dispersed and a concentrated pattern of land development. In all three cases, however, population in each of the WRPA's Hydrologic Basins remained constant.

As noted on page G-13 of this report, the developed land projections of RPA differ from the urban land demands that have been adopted by the ERS of the USDA for use in the linear programming model. The variations in existing and projected urban land area may be attributed to differences in estimating techniques for determining developed (or urban) land, and differing assumptions with respect to projected per capita urban land requirements. Since the techniques and assumptions in both the RPA and ERS studies have been made explicit, it was decided to include both sets of projections in Appendix G. The remainder of this section represents a synopsis of the methodology and findings of the RPA study.

Methodology. County land area and population was compiled by decade from 1910 to 1960. From these data, the gross population density was obtained by county for each of the time periods. Based on studies that RPA had conducted in a 131-county study area, it was found that "intensively developed land" represents approximately 72 percent of total "developed land". The same proportion was applied to determine the amount of intensively developed land within the Atlantic Urban Region. First, the amount of developed land was obtained by measurements from aerial photographs. Of this area, 72 percent was assumed to be intensively developed. Population density was obtained by dividing the urban population of the county by the intensively developed land area.

Some 55 urban subregions were defined by RPA. These were classified into five categories based upon population size and gross density of the central cities in 1960. (The classification was presented on page G-54 of this report but is repeated below for purposes of continuity.)

Class 1 Subregions - Populations over 250,000 and gross densities greater than 10,000 persons per square mile.

Class 2 Subregions - Populations of 150,000 to 250,000 density of 5,000 to 10,000 persons per square mile.

Class 3 Subregions - Population of 75,000 to 150,000 density same as Class 2.

Class 4 and 5 Sub-regions	Under 75,000 population, density under 5,000 persons per square mile.

Population by urban subregion was plotted on semilogarithmic grids by decade from 1910 to 1960. The trend line was extended to the target years and the projection read directly from the chart. The projections for the subregions were then adjusted to conform to the OBE projections for the particular WRPA. The WRPA projections were used as control totals and frequently determined the projection made for each urban subregion. Hence, the only flexibility permitted the RPA forecasting staff was in the allocation of population to the counties and urban subregions within each of the WRPA's.

Population was then plotted by county and projected for the target years using the urban subregion projections as the control totals. Extrapolation of the trend line was determined by use of the following guiding assumptions.

Urban growth tends to proceed radially outward from the central city to the surrounding counties and as close to the central city as possible as long as the density preference is satisfied.

If there is the possibility of radial growth in several directions, those counties with major transportation routes and those lying between two significant urban concentrations tend to experience the greatest growth in urban development.

The population trend lines of the growing counties surrounding the central city tend to level off when roughly 30-50 percent of the land areas has been built up. The exact portion varies with the size of the county and the size of the central city.

If the population increment is great enough, growth then proceeds to the next outer ring of counties, subject to the constraints above. At this point, growth may also take place in counties formerly less favorably endowed with roads but now nearer the central city than those in the next outer ring.

The amount of developed land by county was derived by estimating the developed land density of the population increments for each of the target intervals, 1960-1980, 1980-2000, 2000-2020; dividing the population increment by the estimated density to obtain the increment in developed land by county; and adding the developed land increment to the total amount of developed land in the previous benchmark year.

The developed land density of the population increment by county was determined by a variable method in which two assumptions were explicitly stated. First, it was assumed that most of the population increment between each benchmark year would be accommodated on newly developed land. Secondly, it was assumed that if population declined in a county, no change would occur in the amount of developed land. (A number of exceptions to each of these assumptions was cited.)

A general guide was then developed for estimating the developed land density of the population increment by county. This guide is given below.

Developed Land Density of the Population Increment (persons per developed square mile)	Description of County Developments
1,000	Rural development. Little urban growth.
2-3,000	Exurban and low suburban densities. Counties now have low current densities and are not in path of major urban growth as yet.
4-5,000	Suburbanizing densities. In counties containing or near significant urban development.
6-8,000	Suburbanizing densities near the largest centers. The higher density figure occurs where growth is almost complete and the lower one where considerable growth is still expected.
9-12,000	Urban densities for the last remaining amounts of vacant land in older urban or suburban counties.
15-20,000	The last increments of growth in the older cities of the region.

The final step in the estimating procedure was to break down the developed land increment for each subregion into its residential and nonresidential components. Net residental land was stated to account for generally 50 percent of total land developed, but going as high as 60 percent in rural areas. In converting dwelling units per net residential acre to persons per developed square mile a future dwelling unit population of 3.18 persons per dwelling unit was assumed.

Assumptions used in the Projection of the Most Likely Population Distribution

There will be a continued preference for single family detached homes and private individual modes of transportation with a larger segment of the population able to afford these goods.

Population will continue to suburbanize around the central cities in each subregion.

Current centers will remain strong but there will be some decentralization of jobs within each subregion to suburban areas.

Densities in the central cities will tend to decrease somewhat as people will not want to live at the current very high densities.

Future suburban densities will be the same as those recorded for 1960.

Assumptions Used in the Projection of the Dispersed Development Alternative

People will prefer to live in single family homes on individual lots, to travel by individual modes of transportation and a larger portion of the population will be able to afford these goods.

Population will continue to suburbanize more rapidly about the central cities in each subregion.

Current centers will continue to lose population, especially in the central cities in subregion Classes 1, 2 and 3 and jobs will decentralize within each subregion.

Future suburban densities will be the same as the low range of suburban densities recorded for 1960, generally three or fewer dwelling units per net residential acre.

Assumptions Used in the Projection of the Concentrated Development Alternative

People will prefer to live near their jobs, rather than travel a longer time to work, and will therefore accept higher than current suburban densities.

Central cities, particularly those in subregion Classes 1, 2 and 3, will experience an increase in population as jobs tend to concentrate in the center.

Densities in the central cities and the surrounding counties will increase as most of the region's population becomes concentrated.

Future suburban densities will be in the range of very high current suburban densities, generally six or seven dwelling units per net residential acre.

Summary of Alternative Developed Land Projections

In 1960, developed land accounted for 7,856 sq. miles or 5.6 percent of the AUR's total land area of 141,023 sq. miles.

Total developed land for the most likely alternative is as follows:

1980 - 10,440.9	sq.	mi.	or	7.4	percent	of	the	total	area
2000 - 13,391.6	"	"	"	9.5	"	"	"	"	"
2020 - 16,696.3	"	"	"	11.8	"	"	"	"	"

Total developed land for the dispersed development alternative is as follows:

1980 - 11,076.3	sq.	mi.	or	7.9	percent	of	the	total	area
2000 - 14,557.7	"	"	"	10.3	"	"	"	"	"
2020 - 19,160.2	"	"	"	13.6	"	"	"	"	"

Total developed land for the concentrated development alternative is as follows:

1980 - 9,966.2	sq.	mi.	or	7.1	percent	of	the	total	area
2000 - 12,235.8	"	"	"	8.7	"	"	"	"	"
2020 - 14,619.0	"	"	"	10.4	"	"	"	"	"

Main Characteristics of the Three Alternative Development Patterns

The Most Likely Distribution Alternatives:

Expected 93.7 percent increase in population and 112.5 percent increase in developed land between 1960 and 2020 in the entire region.

An increase in the portion of land developed from 5.6 percent in 1960 to 11.8 percent by 2020.

Continued dominance of Class 1 subregions in the AUR.

Expectation of greater growth in Classes 2, 3 and 4 once Class 1 is approximately 30 percent developed.

Greater suburbanization of population, particularly in Class 1 subregions, a trend most marked in the 1960-1980 time period.

Gradual decrease of the portion of developed land in net residential use as each subregion becomes more fully developed.

The Dispersed Development Alternative:

Expected 93.7 percent increase in population and 143.9 percent increase in developed land between 1960 and 2020 in the region as a whole.

Increase in the portion of total regional land developed from 5.6 percent in 1960 to 13.6 percent by 2020.

Continued dominance of Class 1 subregions in the AUR, both in the portion of total regional population and portion of total regional developed land.

TABLE G-58

TOTAL LAND AREA, AND PORTION INTENSIVELY DEVELOPED BY HYDROLOGIC AREA, 1962
NORTH ATLANTIC REGION

Hydrologic Area	Total Land Area (sq. miles)	Land Intensively Developed (sq. miles)	% of Total Land Intensively Developed
NAR Total (a)	130,500	5,467.8	4.2
Subregion A	1,600(c)	56.0(c)	3.5
1 (b)	-	-	-
2 (b)	-	-	-
3	865(c)	20.5(c)	2.4
4	478(c)	21.8(c)	4.6
5	257(c)	13.7(c)	5.3
Subregion B	28,417	1,493.6	5.3
6	3,861	95.2	2.5
7	4,564	284.8	6.2
8	11,483	253.0	2.2
9	3,782	441.9	11.7
10	4,727	418.7	8.9
Subregion C	21,890(c)	1,070.0(c)	4.9
11	4,880(c)	65.9(c)	1.4
12	15,055	346.6	2.3
13	1,955	657.5	33.6
Subregion D	17,862	1,233.6	6.9
14	2,224	408.4	18.4
15	13,680	713.4	5.2
16	1,958	111.8	5.7
Subregion E	33,669	875.5	2.6
17	26,170	549.6	2.1
18	7,499	325.9	4.3
Subregion F	27,062(c)	739.1(c)	2.7
19	15,457	451.6	2.9
20	5,281	79.1	1.5
21	6,324(c)	208.4(c)	3.3

(a) Excludes 25 counties and 4 independent cities listed on p. G-6
(b) Not within the urban development study area.
(c) Excludes counties and independent cities listed on p. G-6

Source: Study of Present and Projected Urban Development and Land Use in North Atlantic Region (Preliminary Issue), Table 17

TABLE G-59

TOTAL DEVELOPED LAND BY HYDROLOGIC AREA FOR THE MOST LIKELY ALTERNATIVE NORTH ATLANTIC REGION

Hydrologic Area	1980		2000		2020	
	Amount	% of Total Land	Amount	% of Total Land	Amount	% of Total Land
	(sq.miles)		(sq.miles)		(sq.miles)	
NAR TOTAL(a)	10,202.8	7.8	13,057.9	10.0	16,332.8	12.5
Subregion A	90.3(c)	5.6	97.3(c)	6.1	110.9(c)	6.9
1 (b)	-	-	-	-	-	-
2 (b)	-	-	-	-	-	-
3	33.1(c)	3.8	36.0(c)	4.2	40.2(c)	4.6
4	34.2(c)	7.2	35.0(c)	7.3	41.1(c)	8.6
5	23.0(c)	8.9	26.3(c)	10.2	29.6(c)	11.5
Subregion B	2,660.2	9.4	3,405.0	12.0	4,213.8	14.8
6	165.1	4.3	205.5	5.3	252.9	6.6
7	476.5	10.4	648.8	14.2	779.5	17.1
8	431.7	3.8	533.0	4.6	699.9	6.1
9	809.3	21.4	1,009.8	26.7	1,276.6	33.8
10	777.6	16.5	1,007.9	21.3	1,204.9	25.5
Subregion C	1,865.5(c)	8.5	2,228.7(c)	10.2	2,704.2(c)	12.4
11	104.0(c)	2.1	124.8(c)	2.6	149.1(c)	3.1
12	717.3	4.8	959.2	6.4	1,281.3	8.5
13	1,044.2	53.4	1,144.7	58.6	1,273.8	65.2
Subregion D	2,405.2	13.5	3,203.4	17.9	4,091.6	22.9
14	761.9	34.3	984.5	44.3	1,223.1	55.0
15	1,334.8	9.8	1,751.3	12.8	2,281.7	16.7
16	308.5	15.8	467.6	23.9	586.8	30.0
Subregion E	1,774.5	5.3	2,222.6	6.6	2,737.9	8.1
17	1,173.2	4.5	1,432.7	5.5	1,734.8	6.6
18	601.3	8.0	789.9	10.5	1,003.1	13.4
Subregion F	1,407.1(c)	5.2	1,900.9(c)	7.0	2,474.4(c)	9.1
19	903.1	5.8	1,283.9	8.3	1,717.2	11.1
20	128.5	2.4	164.6	3.1	223.7	4.2
21	375.5(c)	5.9	452.4(c)	7.2	533.5(c)	8.4

(a) Excludes 25 counties and 4 independent cities as listed on p. G-6
(b) Not within the urban development study area.
(c) Excludes the counties and independent cities listed on p. G-6

Source: Study of Present and Projected Urban Development and Land Use in North Atlantic Region (Preliminary Issue), Table 18

TABLE G-60

TOTAL DEVELOPED LAND BY HYDROLOGIC AREA FOR
THE DISPERSED DEVELOPMENT ALTERNATIVE
NORTH ATLANTIC REGION

Hydrologic Area	1980 Amount (sq.miles)	1980 % of Total Land	2000 Amount (sq.miles)	2000 % of Total Land	2020 Amount (sq.miles)	2020 % of Total Land
NAR TOTAL(a)	10,717.0	8.2	14,118.9	10.8	18,519.4	14.2
Subregion A	90.7(c)	5.7	104.6(c)	6.5	123.6(c)	7.7
1 (b)	-	-	-	-	-	-
2 (b)	-	-				
3	32.6(c)	3.8	38.4(c)	4.4	46.9(c)	5.4
4	35.1(c)	7.3	40.7(c)	8.5	49.0(c)	10.3
5	23.0(c)	8.9	25.5(c)	9.9	27.7(c)	10.8
Subregion B	2,720.0	9.6	3,597.8	12.7	4,800.8	16.9
6	164.7	4.3	207.9	5.4	274.9	7.1
7	522.4	11.4	747.4	16.4	1,042.4	22.8
8	442.6	3.9	563.2	4.9	774.5	6.7
9	806.7	21.3	1,023.2	27.1	1,325.9	35.1
10	783.6	16.6.	1,056.1	22.3	1,383.1	29.3
Subregion C	2,073.6(c)	9.5	2,474.9(c)	11.3	2,937.0(c)	13.4
11	104.0(c)	2.1	127.0(c)	2.6	156.5(c)	3.2
12	935.2	6.2	1,173.9	7.8	1,408.4	9.4
13	1,034.4	52.9	1,174.0	60.1	1,372.1	70.2
Subregion D	2,601.7	14.6	3,496.4	19.6	4,522.8	25.3
14	845.1	38.0	1,078.7	48.5	1,353.9	60.9
15	1,405.5	10.3	1,913.0	14.0	2,539.0	18.6
16	351.1	17.9	504.7	25.8	629.9	32.2
Subregion E	1,668.0	5.0	2,254.8	6.7	3,028.0	9.0
17	1,005.1	3.8	1,322.4	5.1	1,746.3	6.7
18	662.9	8.8	932.4	12.4	1,281.7	17.1
Subregion F	1,563.0(c)	5.8	2,190.4(c)	8.1	3,107.2(c)	11.5
19	992.9	6.4	1,440.0	9.3	2,095.4	13.6
20	159.0	3.0	235.5	4.5	354.0	6.7
21	411.1(c)	6.5	514.9(c)	8.1	657.8(c)	10.4

(a) Excludes 25 counties and 4 independent cities listed on page G-6
(b) Not within the urban development study area.
(c) Excludes the counties and independent cities listed on page G-6

Source: Study of Present and Projected Urban Development and Land Use in North Atlantic Region (Preliminary Issue), Table 19

TABLE G-61

TOTAL DEVELOPED LAND BY HYDROLOGIC AREA FOR
THE CONCENTRATED DEVELOPMENT ALTERNATIVE
NORTH ATLANTIC REGION

Hydrologic Area	1980		2000		2020	
	Amount (sq.miles)	% of Total Land	Amount (sq.miles)	% of Total Land	Amount (sq.miles)	% of Total Land
NAR TOTAL(a)	9,615.1	7.4	11,814.3	9.1	14,110.4	10.8
Subregion A	85.7(c)	5.4	88.9(c)	5.6	106.6	6.7
1(b)	-	-	-	-	-	-
2(b)	-	-	-	-	-	-
3	31.0(c)	3.6	32.1(c)	3.7	39.0(c)	4.5
4	31.4(c)	6.6	32.6(c)	6.8	40.0(c)	8.4
5	23.3(c)	9.1	24.2(c)	9.4	27.6(c)	10.7
Subregion B	2,569.9	9.0	3,207.1	11.3	3,878.4	13.6
6	166.2	4.3	203.3	5.3	240.9	6.2
7	429.9	9.4	560.7	12.3	702.9	15.4
8	416.6	3.6	498.2	4.3	627.5	5.5
9	813.5	21.5	1008.0	26.7	1,202.9	31.8
10	743.7	15.7	936.9	19.8	1,104.2	23.4
Subregion C	1,710.5(c)	7.8	1,990.2(c)	9.1	2,281.0(c)	10.4
11	102.7(c)	2.1	120.6(c)	2.5	141.2(c)	2.9
12	674.9	4.5	818.1	5.4	976.2	6.5
13	932.9	47.7	1,051.5	53.8	1,163.6	59.5
Subregion D	2,351.2	13.2	2,956.2	16.6	3,573.1	20.0
14	799.5	35.9	948.5	42.6	1,074.3	48.3
15	1,259.4	9.2	1,615.1	11.8	2,005.8	14.7
16	292.3	14.9	392.6	20.1	493.0	25.2
Subregion E	1,524.9	4.5	1,904.6	5.7	2,316.8	6.9
17	978.3	3.7	1,237.8	4.7	1,518.1	5.8
18	546.6	7.3	666.8	8.9	798.7	10.7
Subregion F	1,372.9(c)	5.1	1,667.3(c)	6.2	1,954.5(c)	7.2
19	812.7	5.3	1,018.8	6.6	1,213.0	7.8
20	131.9	2.5	154.1	2.9	176.7	3.3
21	428.3(c)	6.8	494.4(c)	7.8	564.8(c)	8.9

(a) Excludes 25 counties and 4 independent cities listed on p. G-6
(b) Not within the urban development area.
(c) Excludes the counties and independent cities listed on p. G-6

Source: Study of Present and Projected Urban Development and Land Use in North Atlantic Region (Preliminary Issue), Table 20

Significantly greater suburbanization of population (much more so than in the most likely alternative), particularly in Class 1 subregions during the 1960-1980 time period.

Gradual increase in the portion of developed land in residential use as average lot sizes for homes become increasingly larger.

Sufficient amount of vacant land in the region to accommodate future low density growth, if policies are formulated to encourage this alternative.

The Concentrated Development Alternative:

Expected 93.7 percent increase in population and 86.1 percent increase in developed land between 1960 and 2020 in the region as a whole.

Increase in the portion of total regional land developed from 5.6 percent in 1960 to 10.4 percent in 2020.

Continued dominance of Class 1 subregions, both in their portion of total regional population and of total regional developed land, despite a very slight trend toward a more even class distribution of developed land.

Greater concentration of population, particularly in Class 1 subregions after 1980.

Gradual decrease in the portion of developed land in residential use, to a lower level than for the most likely alternative by 2020, as each subregion becomes more fully developed.

Water as an Economic Recreational and Aesthetic Resource

Water, the natural resource on which all life depends, is indispensable to the continued existence of the city. It takes approximately 65,000 gallons of the right sort of water, for example, to process a ton of steel. Every gallon of refined gasoline bought by a car-owner requires 7 to 10 gallons of water in its production. Water provides a means of transportation, facilitates waste disposal, generates power and furnishes fire protection. As a pleasure producing element, however, its value transcends the strictly utilitarian. One cannot measure, in economic terms, the sheer delight experienced by a city family from a mid-summer pilgrimage to the ocean.

Every major city in the NAR is located on either a river or an estuary. In almost every instance, the water is polluted and precludes swimming. As a result, water is frequently brought from remote reservoirs to fill a usually inadequate number of swimming pools. If convenient and inexpensive access could be provided to these rivers and estuaries, and at least part of the water area raised to acceptable standards of quality, the recreational needs

of many urban residents could be more completely met, and correspondingly larger facilities could be developed. The construction of physical barriers separating clean from dirty water might conceivably accomplish this and would require purification of only a relatively small percentage of the water within the system.

There is every reason to believe that people experience great delight and pleasure from fountains in the city. In recent years, corporate offices and industries that have relocated in the suburbs have often utilized the water-cooling demands of air conditioning to create attractive fountains and pools. Thus, functional need can contribute to positive visual interest. In the center city, with its high concentration of air conditioned buildings, it should be possible to fashion a series of fountains utilizing a recirculating system within a multibuilding network. Paley Plaza, a vest pocket park in midtown Manhattan, is a popular oasis for tourists and office workers alike, the interplay of cascading water and trees acting as a natural buffer against the incessant din of traffic only a few strides from the entrance.

Waterfront Potential

In most cities today, physical access to the waterfront is extremely limited for most persons. These water edges and surfaces constitute the largest unexploited opportunities for providing a visually pleasing setting for city dwellers who cannot afford to travel to the mountains or the country. When visible, the water surface is a major open space that offers necessary surcease from the concrete canyons of the city and its crowded streets. This water surface could provide rich recreational opportunities within the area normally serviced by public transportation in most cities.
portation in most cities.

Fingers of open space along the waterfront can provide opportunities for aquaria as in Boston, and promenades and maritime museums such as those proposed in Philadelphia's riverfront renewal as well as the more typical marinas, restaurants, small parks and beaches. The water edge should be a union of the water with the city rather than a barrier. Carefully placed openings in the wall of structures along the working waterfront of docks and warehouses can visually project water into the center city. Beyond this, it can enable residents and visitors to use that open space for physical access to the water and as a vantage point for watching waterfront activities.

Old buildings along the waterfront, usually located in the most deteriorated areas of the city, may provide space for community centers, or for residential and related commercial development. An old factory on a pier in Boston's inner harbor has just undergone such a change in use and now contains 32 apartments and parking for a similar number of cars. Care must be exercised, however, to couple changes in uses with changes in accessibility.

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Waterways and Metropolitan Form

At the metropolitan scale, the waterways - river, streams and drainageways - normally exist in their seminatural state as edges and sometimes as pathways. As such they are potentially major determinants of the form of ever-expanding metropolitan areas. The inclusion of the water source and its land areas in the open space system can enhance its role and importance as an edge. As a band of undeveloped landscape, it stands in contrast to the adjacent developed land, and it serves as a visual boundary and a definer of the form of the development.

If, on the other hand, development encroaches and the center line of the stream or river becomes the back lot line for a series of subdivision lots or is encased in a concrete ditch in the name of efficiency, the visual value as part of the public landscape would be destroyed. The value of the water course as an element in defining the limits of a sector of metropolitan growth is completely lost, and the chance of creating extensive recreational opportunities for the public is effectively eliminated. Washington, D.C., Baltimore and Boston, as well as other cities in the NAR, have partial open space systems developed around water courses.

Flood Hazards and Flood Plain Management

Flood hazards have been notoriously ignored in urban development. Residential and industrial construction has occurred in flood plains throughout the NAR.. Floods are natural phenomena that cannot be prevented. The damages arising from flooding, however, can be reduced by two primary means: through engineering devices - reservoirs, dams, dikes, flood walls, etc. - and through land use controls and building regulations. The appropriateness of the means depends upon local or basin characteristics.

Considerably more emphasis has been placed on the use of engineering devices. Regulatory action to restrict urban development in areas of potential flood hazard has been weak and often ineffectual. It is reported that in one of the most highly urbanized states within the NAR there only eight communities which had adopted flood plain zoning regulations as of 1967. The record is hardly better throughout the remainder of the region.

Much of the agricultural land that will be converted to urban use in the coming decades is located within the lowland areas of river valleys. It is imperative, therefore, that state planning agencies throughout the NAR delineate areas of potential flood hazard for the guidance of local and metropolitan planning bodies. The delineation and mapping of such areas, however, is only a first step. Engineering and regulatory measures must be implemented at the appropriate governmental level in order to achieve the following objectives: prevent existing flood problems from becoming worse; guide new development to prevent the occurrence of additional flood hazard problems; develop long-range, comprehensive

plans for the balanced use of flood plains throughout individual basins.

The foregoing objectives can be implemented through various physical and regulatory measures depending upon basin or local subbasin conditions. Alternative nonphysical measures for implementation include: public land acquisition of flood plain areas for use as park or other permanent open space; flood plain zoning; subdivision regulations and building design standards; and delineation of channel and floodway encroachment lines. The choice of these alternatives, and the weighing of physical against regulatory measures will depend upon specific conditions obtaining within particular basins or subbasins of the NAR.

Watersheds and Urban Use

Many of the cities within the NAR own extensive tracts of watershed land. Little attention has been directed at the potential use of such land for selective types of urban development - new communities, for example. It might also be useful to consider the planning of water resource facilities as controls on the rate and direction of urban expansion. The designation of water recharge areas could be used to selectively exclude or contain urban development. On another level, however, the acquisition of reservoir sites might be carried out in conjunction with efforts of public development corporations to establish new communities in areas that could be protected from encroachments.

Water Management in Urban Areas

The availability of water to serve urban needs is dependent upon two primary factors - the adequacy of supplies and the efficiency of the distribution systems serving urban areas. In the case of the New York Metropolitan Region, for example, it was found that while overall supplies might be adequate, some areas could experience shortages while surplus water was locked in elsewhere in the system without any means of transfer. With over 400 public and private water agencies in the New York region, water distribution constitutes a major management problem. Similar problems of diffused management, the absence of overall network planning, limited interconnections between competing water systems, and imbalances between population movement and system capacities probably exist within many of the metropolitan areas of the NAR. Even with assured sources of water supply, these institutional and political problems remain to be dealt with.

LAND FOR FOOD AND FIBER NEEDS

Land Use Projections

This section is devoted primarily to an analysis of the Region's potential to produce food and fiber in amounts that are consistent with projections of future national demands. However, it is recognized that other multiple uses of the limited land resource will have considerable effect on the land use pattern. Therefore, selected planning alternatives such as urban development and environmental enhancement were included in the analysis. Projected land use patterns are based on the results of this analysis. The multiple-use aspects (watershed, recreation, wildlife habitat, environmental quality) of agricultural and forest land must be considered in addition to meeting selected production projections. Therefore, numerical results of these analyses must be considered as an indication of future land use only under the limited characteristics of the analytical model.

Methodology and Assumptions

Linear programming was one of the analytical techniques utilized in analysis of land use patterns. As used in the North Atlantic Regional Study, linear programming will assist in the evaluation of the consequences—beneficial or detrimental—of redirecting the development of the Region's land resources to achieve the three planning objectives of the NAR Study.

The first objective considered was economic efficiency, i.e., planning land use to provide food and fiber at a relatively low cost. In a region where agricultural lands are being converted to urban use at a rapid rate, orderly urban development was considered as an important alternate objective. The recent emphasis on environmental quality led to the consideration of the third objective, enhancement of the environment in terms of visual quality (natural beauty). Consideration of each of these objectives requires a different set of assumptions concerning resource availability, productivity and managerial factors. The linear programming model serves as an accounting tool demonstrating the estimated differences in land use associated with the attainment of these different planning objectives. It is not intended that model outputs will be outright predictions of land use or production patterns, but they should depict possible land use patterns as background data for policy guides and program formulation.

Development and Capability of the Model.[14] The linear programming model used in the analysis of land use was developed by the Economic Research Service, U. S. Department of Agriculture, in cooperation with the McDonnell Automation Company of St. Louis, Missouri. It is highly flexible in the sense that constraints can be built into it to reflect varying sets of assumptions with respect to changes in production technology, resource organization, government programs and many other factors affecting land use and productivity. The application of the model under the various assumptions and constraints provides an opportunity to study the estimated effects and impacts of different policy proposals.

Recognized limitations of the model as used in this Study include those imposed by the comparability, specificity, and accuracy of the data inputs. Since the model was first developed and utilized for agricultural analysis only, more knowledge and experience were available for the agricultural than the forestry inputs. Productivity, yield, and cost data, demand data specific to the region, and determination of hardwood versus softwood sawtimber requirements for wood product production are some examples of specific forest input data which were developed as a first attempt in such detail for a Type I Study. For this reason, forest land requirements should be used only within the context of this discussion. Additional time and experience in the development and use of these forest data would significantly enhance the product and assure greater comparability and reliability of the model's output.

Data Requirements. The information needed to make the model operational generally includes four items: (1) the land resource base in the study region, (2) the existing patterns of land use on the smallest type of land aggregation which reflect differences in productivity, Soil Resource Group (SRG)1/, (3) production costs for each activity by SRG, and (4) current and projected yields by activity on each SRG.

The 1958 Soil and Water Conservation Needs Inventory (CNI) prepared by the U. S. Department of Agriculture under leadership of its Soil Conservation Service was the primary source of the basic land inventory. Cropping patterns, yield and fertilizer use information by SRG were obtained for Land Resource Area (LRA)1/ sample counties from the Soil Conservation Service's District Conservationists and adjusted by Census of Agriculture county data. Forest Survey data by state were used in conjunction with the CNI, and stratified by forest type and productivity to obtain units of major forest products. (For uniformity with agricultural treatment, these will be referred to as cropping patterns). These data were expanded to match the LRA land inventory.

Since cost is an important decision criterion for estimating patterns of production in the minimum cost model, it was necessary to delineate the Region into subregions which can be characterized by reasonably homogeneous crop production costs. There is little basis for assuming that the factors of production are more efficient in any given river basin since large drainage areas are not necessarily homogeneous in nature. Therefore, the more homogeneous LRA's superseded the river basin delineations for this analysis.

The Land Resource Areas (LRA) developed by the Soil Conservation Service consisted of geographically associated land resource units that are characterized by particular patterns of soil, climate, water

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1/ Definitions of SRG and LRA appear on pages G-154 and G-155.

resources, land use and types of farming. Figure G-5 presents a map location and Table G-3 has a detailed description of the Region's LRA's.[1/]

The Region's LRA's have been further delineated into land capability classes I through VIII which, in turn, are divided into subclasses e, w and s. The smallest unit is referred to as a soil resource group (SRG). Land capability classes V through VIII were combined into one SRG since this land is not generally suitable for cultivated crop production.[2/]

The following is a listing of the land capability classes and subclasses and corresponding SRG's in the model.

Class and/or Subclass[3/]	SRG[4/]
I	101
IIe	211
IIw	221
IIs	231
IIIe	311
IIIw	321
IIIs	331
IVe	411
IVw	421
IVs	431
V - VIII	601
Water surface	702

Once the land inventory, cropping patterns and yield information had been completed, crop production costs were budgeted for each crop by LRA-SRG. The basis for establishing these individual costs was obtained in a very eclectic manner. Sources of information ranged from State and Federal publications to subjective evaluation.

Agricultural yield projections were developed by the use of linear regression analysis over time. Time series data by crop were obtained from Statistical Reporting Service reports. Annual incremental changes taken from the regression equation were used to prepare an index of expected change in productivity from the estimated 1964 normal yield. This index was utilized to derive the 1980 yield estimates by crop. Adjustments were made to resolve substantial differences between

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1/ Because of its small size, LRA 101 is combined with LRA 140.

2/ This combination was also accepted for forest production on a trial basis to facilitate the study; however, for forest product analysis, it may be desirable to break down this combination.

3/ The letter denotes subclass. If no letter is listed, the subclass is not considered. Subclasses are defined on page G-25.

4/ The last digit in the SRG code has no meaning in this analysis and could appear as a 1 or 2.

these yields and those used in nearby Type I river basin investigations. Yield projections for 2000 and 2020 were carried out in a similar manner.

Forest yields were obtained from forest yield tables for the four broad forest types. Yields were expressed in cubic feet for pulpwood and in board feet for sawlogs. Yields were projected to increase slightly for 2000 and 2020.

Projections of Production. Subject to the assumptions and specific constraints discussed in this report, the objective function of the linear programming model is to satisfy prespecified volumes of production either at minimum cost or maximum profit. Food, feed, and fiber needs of the Region cannot be considered in isolation from national needs due to interregional economic relationships. Therefore, regional projections of production were developed consistent with national allocations to the NAR water resources region. (15) These projections serve as a base from which planning alternatives can be compared when evaluating alternative assumptions. (Table G-62).

Projections of production were stratified by crop groups consisting of one or more crops in specified amounts. Any crop within a group can contribute towards the group's total product. The sum production of all crops in a group must equal or exceed the output projected for that specific group. Otherwise, an optimal solution would be impossible. Production in excess of projections will be attained only if constraints elsewhere in the model would force the solution to produce more than specified. If all resources are perfectly mobile, there should be no excess production.

The following are crop groups used in this model:

Crop Group	Crop
01	Corn Grain
02	Oats
03	Barley
04	Wheat
05	Rye
08 1/	Alfalfa Hay
08 1/	Small Grain Hay
08 1/	Other Hay
08 1/	Clover-Timothy Hay
08 1/	Lespedeza Hay
09	Corn Silage
09	Grass Silage
10	Cropland Pasture
10	Improved Pasture
10	Unimproved Pasture
10	Unimprovable Pasture
10	Grazed Forest

1/ Hay yields were adjusted so that feed values from hay acreages would be equal. Clover-Timothy, Small Grain and Lespedeza yields were multiplied by 0.82. "Other Hay" yields were adjusted by 0.73. Alfalfa = 1.00. (16).

TABLE G-62

CURRENT AND PROJECTED PRODUCTION REQUIREMENTS FOR MAJOR AGRICULTURAL AND FOREST PRODUCTS, 1959-61, 1980, 2000, and 2020
NORTH ATLANTIC REGION

Commodity	Unit	1959-61	1980	2000	2020
Wheat	Bu.	22,407	24,600	28,500	34,100
Oats	Bu.	37,769	43,066	40,031	29,525
Barley	Bu.	17,076	19,879	20,265	18,952
Rye	Bu.	1,415	2,022	2,648	3,564
Corn	Bu.	99,537	109,980	145,360	193,667
Soybeans	Bu.	19,318	35,248	44,305	57,142
Tobacco	Lbs.	117,767	128,800	169,800	227,300
Peanuts	Lbs.	97,429	78,100	107,100	148,000
Potatoes	Cwt.	73,435	88,994	121,808	169,774
Sweet Potatoes	Cwt.	1,260	4,247	5,858	8,122
Fruit	Cwt.	25,028	31,574	45,441	64,949
Vegetables	Cwt.	34,468	73,857	101,321	139,970
Corn Silage	Tons	7,912	12,461	16,075	26,166
Hay	Tons	10,905	8,888	9,703	10,339
Pasture	AUD 1/	512,356	481,936	584,848	650,481
Pulpwood	cu/ft		688,439	1,023,457	1,165,079
Saw Timber	bd/ft		3,183,700	3,791,992	4,360,479

1/ An Animal Unit Day is the quantity of pasture needed to sustain a cow and calf for one day.

11	Soybeans
12	Potatoes
13	Other Crops
15	Fruits and Nuts
16	Vegetables
17	Tobacco
18	Sweet Potatoes
19	Peanuts
20	Other Pulp - Saw 1/
21	Spruce Fir Pulp Wood
21	Northern Hardwood Pulp
21	Oak Hickory Pulp
21	Southern Pine Pulp
22	Spruce Fir Saw Timber
22	Northern Hardwood Saw Timber
22	Oak-Hickory Saw Timber
22	Southern Pine Saw
23	Urban Land
24	Other Land
26	Water Surface > 40 acres
27	Water Surface < 40 acres

Estimates of product demand for the time frames 1980, 2000, 2020, of two selected forest products (pulpwood and sawtimber) were developed from statements of national projection estimates. These data were in terms of cubic foot volume and were extrapolated to the target years. National population estimates were divided into the volume estimates to derive per capita consumption rates. These rates were multiplied by regional population projections (Appendix B) to derive regional estimates of demands.

Vegetable crops have not been budgeted in the model since the basic data were gathered by the general category "vegetables." Thus, current yields and production could not be obtained for this general category. Neither were tobacco, peanuts and sweet potatoes budgeted. These are considered fairly localized crops for which data can best be manipulated outside the model. Certain acreages are specified as needs for vegetables, fruits, tobacco, peanuts and sweet potatoes and are analyzed in relation to the amount of available land remaining in the Region. Projections for forest uses were not developed for purposes other than wood production.

Assumptions Underlying Selected Planning Alternatives.

Three "runs" or computer operations of the linear programming model were used to produce three sets of projections consistent with the planning objectives of efficiency of production, urban and other development, and visual quality discussed on page G-159. The assumptions underlying these runs are presented in the following paragraphs.

1/ This item is seedlings and saplings.

"Solutions" of the model provide the basic data for projections shown in the tables accompanying the discussion.

Efficiency. Theoretically, an efficiency run would permit the model to obtain an optimal solution which is completely unbounded. All resources would be perfectly mobile, and the land available would be the only bounds on the solution. In a theoretical sense, this solution would represent the long-term land use pattern if requirements were to remain constant (assuming other types of land development did not preempt any acreage from agricultural and forest production). Under a completely unconstrained run, the optimal solution could place all of the agricultural production in one LRA if sufficient acreage were available.

It was decided that even fifty years could not be considered as "long run" since it is doubtful that all of the current obstacles to change could be completely overcome in that period of time. However, the model was specified to allow land use patterns to be consistent largely with the principle of comparative advantage. Thus, for most competing activities, lower and upper limits were not permitted to fall below 10 percent or exceed 900 percent, respectively, of the current acreage within that activity. That is, the land used for each crop in each SRG is constrained to be at least 10 percent of the current acreage but not greater than 900 percent. By maintaining the model as unconstrained as seemed practical, more meaningful results can be obtained concerning the direction of land resource development.

Urban and Other Development. Land use shifts per capita from rural to urban uses were obtained from unpublished data of the Economic Research Service.(17) These shifts were obtained for each of the six major subregions in the North Atlantic Region. The per capita shifts were applied to the OBE-ERS population projections for each of the target years to estimate the amount of additional land needed for urbanization in the Region. It was estimated that the following numbers of additional acres would be needed for urban development in the North Atlantic Region:

Time Span	Acres
1960-1980	2,217,000
1960-2000	4,863,000
1960-2020	8,775,000

Additional acres of urban development were divided among the fourteen Land Resource Areas in proportion to estimates of current urban land use.

Additional unpublished data indicate the percentage of land by capability class that has been urbanized historically. (Table G-63). Using the assumption that land will continue to be developed in a similar pattern, the acreage that had been delineated to Land Resource Areas was further assigned to each capability class. These acreages

TABLE G-63

COMPARISON OF LAND URBANIZED TO TOTAL AREA
BY LAND CAPABILITY CLASS 1/ 2/
NORTH ATLANTIC REGION

Land Capability Class	Upper States 3/		Middle States 4/		Lower States 5/		Total Region	
	Total Area	Land Urbanized	Total Area	Land Urbanized	Total Area	Land Urbanized	Total Area	Land Urbanized
	(Percent)							
I	01.4	02.9	02.7	04.3	04.2	03.7	02.5	03.7
II	14.2	47.5	21.4	58.8	32.1	44.1	20.5	50.7
III	09.7	27.9	20.1	15.5	32.8	37.8	18.5	26.5
I-III	25.3	78.3	44.2	78.6	69.1	85.6	41.5	80.9
IV	09.0	06.1	13.1	07.0	08.3	06.5	11.2	06.6
V	01.0	00.0	00.0	00.0	00.6	00.1	00.4	00.0
VI	27.3	08.1	19.3	02.7	09.3	05.5	20.5	05.1
VII	34.4	07.5	21.6	11.7	07.7	02.3	23.8	07.4
VIII	03.0	00.0	01.8	00.0	05.0	00.0	02.6	00.0
IV-VIII	74.7	21.7	55.8	21.4	30.9	14.4	58.5	19.1
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1/ Economic Research Service, USDA., Unpublished Memorandum.
2/ Total areas of study counties (109) exclusive of urban and federally owned lands, 1958 Conservation Needs Inventory.
3/ Upper Land Resource Areas, Nos. 142, 143, 144, 145 and 146
4/ Middle Land Resource Areas, Nos. 127, 140 and 147.
5/ Lower Land Resource Areas, Nos. 128, 133, 136, 148, 149 and 153.

TABLE G-64

ACREAGE REMOVED FROM AGRICULTURAL PRODUCTION
FOR URBAN DEVELOPMENT
BY LAND RESOURCE AREA AND SOIL RESOURCE GROUP
1964 - 1980
NORTH ATLANTIC REGION

Land Resource Area	Soil Resource Group										
	101	211	221	231	311	321	331	411	421	431	601
						(Acres)					
127	7,876	103,397	2,154	2,154	26,688	1,420	284	11,924	641	256	26,376
128	2,656	26,941	1,858	978	24,891	502	0	3,786	129	0	5,244
133	878	5,238	1,467	3,771	5,832	898	2,245	865	0	679	1,876
136	1,594	18,045	570	380	14,816	488	977	2,744	56	0	5,402
140	7,551	97,070	4,131	2,065	23,138	3,811	272	9,220	492	2,582	25,289
142	2,408	30,370	1,183	7,890	9,962	6,023	7,182	2,583	1,165	1,317	12,954
143	5,318	60,110	7,840	19,164	29,164	3,070	18,931	7,495	1,342	2,349	28,609
144	13,483	152,377	22,084	46,376	54,479	3,891	71,342	16,165	3,403	8,792	72,527
145	2,536	27,816	6,233	4,986	7,810	732	15,864	320	907	4,109	13,646
146	160	1,866	315	447	740	46	756	64	57	216	863
147	7,666	99,590	3,145	2,096	24,594	1,105	1,934	10,358	249	1,872	25,676
148	10,654	120,645	3,810	2,540	100,142	4,354	4,354	16,284	562	1,872	22,749
149	11,739	93,744	13,992	32,180	47,972	19,189	52,769	19,386	0	1,237	25,065
153	4,395	37,192	7,857	7,334	7,184	20,205	17,511	6,330	0	1,390	9,384
TOTAL - NAR	78,914	874,401	76,639	132,361	377,412	65,734	194,421	107,524	9,003	26,671	275,660

were further divided into Soil Resource Groups utilizing the proportions of each land class that were in each Soil Resource Group.[1/] Table G-64 contains the final distribution of land removed for urban development for 1980.

Very little consistent information is available on the relationship between the amount of land devoted to highways, industry, public parks, utilities, and urban development. It was assumed that there is an association between the two types of development. In the North Atlantic Region, there is approximately an equal amount of Urban and Other acreage. Therefore, it was assumed that there would be an acre of Other development for each acre of Urban.

Most Other constraints on the model remain consistent with the 1980 efficiency run. An exception is that the Urban development acreages from Table G-64 were added to the original Urban and Other categories and forced to the grand total in the solution. This manipulation removes Urban development acreage from potential agricultural or forest production.

Visual Quality. A study was conducted by the Research Planning and Design Associates, Incorporated, of Amherst, Massachusetts, under contract with the U. S. Army Corps of Engineers and the USDA, to assess the visual quality of the Region's environment and to develop landscape quality constraints. These constraints were developed primarily for use in the Economic Research Service's linear programming model.

Several important factors must be emphasized when considering the development and use of constraints such as the following for the visual quality of the landscape. The constraints are presented as optimum percentages of various land uses in the rural regional landscape including cropland, pasture, forest, and water surface. The amount or percent of a given area in a single use is only one aspect of the visual landscape. Distribution of forest, cropland or pasture can be more important than quantity or percentage of the total land area. For example, two counties may both have 50 percent forest cover, but one may have all of the forest land confined in the northern half of the county while, in the other, it may be uniformly distributed in 60 to 200 acre blocks across the entire county. Obviously, the pattern created is completely different. In the former, the pattern is uniform. In the latter, the pattern can be very diverse.

Land form, such as mountains, steep hills, rolling hills, undulating land or flat land, also plays an important role in visual landscape quality. The relationship of pattern (man-made or natural) to land form is such that pattern normally becomes less important as land form becomes more pronounced. For example, in a mountainous landscape,

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1/ An additional refinement was added here. It is believed that "e" soils are better for development than "s", which, in turn, are better than "w". Therefore, the percentages for delineating classes into soil resource groups were weighted by the following: 5-e, 4-s and 1-w.

pattern plays a relatively minor role in generating visual quality compared to its absolutely essential role in flatter landscapes. In the case of the flatter landscapes, pattern may be the only significant factor contributing to visual diversity and contrast.

In mountain and steep hill landscapes, variety can be, and is, created by the numerous opportunities that exist for viewing the landscape from different vantage points, such as a mountain or hilltop, hillside or valley floor.

The general approach to the visual quality analysis is to incorporate the constraints into the linear programming model. These constraints were entered in relation to the current patterns of land use. For example, if a constraint for forest land specified that forested area in an LRA should be 70 to 90 percent of the total area, and the current forest land is only 60 percent, then forest acreage was increased to equal 70 percent at the minimum and 90 percent at the upper limit. Therefore, an optimal solution would contain a total amount of forest land in the LRA within the range of 70 to 90 percent of total area. (Table G-65).

Water surface acreage was constrained at the midpoint of the specified range. This was done because water acres were not designated as a competing activity and would always come in the solution at the lower limit regardless of the limits specified, since zero cost is assumed by the model for non-competing activities.

In some of the LRA's, the current land use patterns were considered adequate for visual quality. It was assumed that a variation between 80 and 120 percent of the current land use patterns would, for all practical purposes, represent the criteria of "no change".

A new optimal solution for 1980 visual quality was obtained with the above constraints. This solution was then analyzed in relation to the 1980 efficiency run.

Land Use Patterns.

Current land use patterns do not reflect the most efficient use of the Region's land resources. Since the model serves as a land allocator on the basis of most efficient production, it is important to know the existing degree of inefficiency as well as pattern of land use to meet current production requirements if at a most efficient position. Thus, two runs of the model were made for 1964.

Current. The first run was based on current acreage and yields. The derived total production was then utilized in the second run as requirements to be met at least cost. The second or efficiency run utilized the constraints outlined on page G-159.

Comparisons of the two runs indicate total cost could be reduced by approximately 36 percent through land use shifts. The average

TABLE G-65

MINIMUM AND MAXIMUM ACRES NEEDED
TO MEET VISUAL QUALITY CONSTRAINTS
BY LAND RESOURCE AREA,
NORTH ATLANTIC REGION 1/

Land Resource Area	Open 2/		Forest		Additional Water Surface Acres Needed
	Lower Limit	Upper Limit	Lower Limit	Upper Limit	
127	224.4	1,182.7	3,820.0	5,063.6	201.3
128	823.6	1,235.3	1,833.8	2,750.6	74.9
133	105.4	158.1	203.8	305.6	18.0
136	382.4	575.2	943.0	1,501.7	70.5
140	2,896.2	4,344.3	6,126.2	9,189.4	149.3
142	1,105.9	1,965.0	1,078.2	1,725.1	0.0
143	1,293.0	1,941.7	13,254.4	19,881.7	0.0
144	2,215.0	3,241.5	10,309.4	10,875.8	0.0
145	298.8	483.7	1,108.4	1,291.1	0.0
146	252.7	379.1	3,065.0	4,597.5	0.0
147	2,634.7	3,952.1	4,177.9	6,266.8	0.0
148	3,184.0	4,776.1	3,637.1	5,455.6	231.2
149	1,069.4	1,604.1	2,956.8	4,435.2	0.0
153	1,075.1	1,612.6	1,130.2	1,695.3	0.0
TOTAL- NAR	17,560.6	27,451.5	53,644.2	75,035.0	745.2

1/ In many of the Land Resource Areas, the constraints had been developed by county groups that were sub-portions of the Land Resource Area. This was done because some areas tended to vary significantly from the general landscape pattern in the Land Resource Area. Since there is no provision in the Model for constraining Land Resource Area sub-portions, these constraints had to be combined into one set for each Land Resource Area as follows:

$$\sum_{i=1}^{n} C_{\ell_i} = LRA_\ell$$

where, C_{ℓ_i} = Lower limit for i^{th} county group in each LRA.

$$\sum_{i=1}^{n} C_{u_i} = LRA_u$$

C_{u_i} - Upper limit for i^{th} county group in each LRA.

LRA_ℓ, LRA_u = Lower and Upper LRA limits, respectively.

2/ Cropland and Pasture.

cost per acre reduced from $18.81 to $11.95. At the same time, total acreage needed to meet projected production could be reduced by about 19 percent or 1,093,000 acres. The acreage needed to meet the projected production of hay actually increased by nearly 10 percent. Although hay production became less efficient, total production costs in the Region were reduced as a result.

Total land needs to meet pasture and pulp projections varied only slightly. However, acreage for sawtimber production could theoretically be reduced by more than 50 percent. This could be accomplished by shifts of sawtimber production to more productive Soil Resource Groups.1/ It is obvious that this is unrealistic in a short run situation due to projected production given for each target date which is an insufficient time period to obtain sufficient sawtimber production. Most of the increases in idle land would result from the reduction of land needed for sawtimber production in the less productive capability classes. Table G-66 compares the results of the various runs.

Results for 1980

Efficiency. The optimal solution for 1980 has allocated approximately 10 percent of the total land area to cropland. Hay crops accounted for 5.9 million acres while feed and food crops utilized 5.3 million acres.2/ Other projections made outside the model have previously predicted slightly more than 11 percent in 1980. In 1963, approximately 15 percent of the area was in cropland. Certain LRA's seemed to have a comparative advantage in production costs. LRA's 140, 147, 148, 149 and 153 will have approximately 85 percent of the NAR's cropland but only 41 percent of the land area. Although LRA's 140 and 148 have only 13 and 9 percent, respectively, of the total land area, the land in crops in these LRA's will increase substantially. It should be noted that a good portion of this crop allocation in 140 and 148 is in low value hay land. (Tables G-67 and G-68).

Approximately 7 percent of the land area would be utilized to meet pasture demands under the 1980 efficiency assumption. About two-thirds of this demand would likely be met in LRA's 128, 147 and 148.

The requirements for forest products could be met on lesser acreage of the resource base under the assumptions of the Efficiency objective. Additional acreages allocated to the idle category would become available for forest production over time. Owing to the long rotation period required to attain forest production, the model constraints are quite restrictive for the 1980 run. In view of this problem, the model run merely indicates the direction of land use shifts for the most efficient production only.

1/ This phenomenon is discussed in detail in the section on Land Use Analysis and Planning opportunities which subjectively evaluates the Model solutions.

2/ Includes acreage in specialty crops.

TABLE G-66

CURRENT AND PROJECTED LAND USE ESTIMATES
CONSISTENT WITH VARYING PLANNING ALTERNATIVES
BY LAND RESOURCE AREAS,
NORTH ATLANTIC REGION

		Primary Objective					
Crop[1/]	Actual	Production Efficiency[2/]			Visual Quality	Urban Development	
	1964	1964	1980	2000	1980	1980	2020
	(Thousand Acres)						
Land Resource Area 127							
Feed Crop	164.8	53.4	53.8	49.8	80.9	53.8	62.4
Food Crop	63.8	5.8	5.8	5.8	10.0	5.8	5.6
Hay	290.1	92.3	89.9	92.3	161.8	89.9	335.9
Pasture	498.7	210.0	140.1	142.9	294.2	140.1	184.6
Pulp	1,085.1	794.6	160.5	524.4	1,128.7	514.5	381.7
Sawtimber	1,627.6	713.6	560.4	707.8	1,774.1	426.0	895.9
Other Forest	727.0	727.0	727.0	727.0	727.0	727.0	589.6
Idle	28.1	1,816.4	2,129.2	2,208.2	281.3	2,129.2	1,798.0
Land Resource Area 128							
Feed Crop	95.6	118.5	135.4	135.4	84.1	135.4	173.9
Food Crop	24.2	3.7	3.7	3.7	19.9	3.7	3.6
Hay	185.0	50.2	18.5	18.5	148.0	18.5	27.6
Pasture	946.7	2,174.3	2,295.9	2,293.0	773.9	2,295.9	2,402.5
Pulp	774.1	178.2	77.4	135.7	619.3	135.7	115.3
Sawtimber	985.2	438.5	242.7	317.0	788.2	183.5	273.7
Other Forest	294.6	294.6	294.6	294.6	294.6	294.6	187.2
Idle	5.1	52.6	111.5	112.8	582.6	111.5	9.9
Land Resource Area 133							
Feed Crop	33.2	10.3	10.3	10.3	27.1	10.3	10.3
Food Crop	41.0	34.4	34.4	34.4	41.4	34.4	34.3
Hay	10.0	1.0	1.0	1.0	8.0	1.0	1.0
Pasture	20.7	43.8	44.8	46.9	16.0	44.8	44.6
Pulp	96.9	55.4	9.7	13.7	77.6	12.0	49.5
Sawtimber	86.7	34.6	17.2	26.1	69.4	26.1	41.2
Other Forest	64.0	64.0	64.0	64.0	64.0	64.0	51.5
Idle	2.9	111.8	114.2	158.9	51.6	114.2	92.0
Land Resource Area 136							
Feed Crop	40.8	9.5	8.4	9.5	51.3	8.4	13.2
Food Crop	25.7	3.2	3.2	3.2	33.3	3.2	3.2
Hay	65.7	7.7	6.6	6.6	78.8	6.6	6.6
Pasture	246.2	319.2	319.7	321.0	279.8	319.7	320.4
Pulp	407.5	265.1	40.7	40.7	374.9	40.7	173.9
Sawtimber	364.6	243.7	126.2	175.4	335.4	145.5	273.2
Other Forest	233.1	233.1	233.1	233.1	233.1	233.1	176.5
Idle	7.4	309.4	549.2	601.3	95.8	549.2	293.7

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TABLE G-66

CURRENT AND PROJECTED LAND USE ESTIMATES
CONSISTENT WITH VARYING PLANNING ALTERNATIVES
BY LAND RESOURCE AREAS,
NORTH ATLANTIC REGION

Crop[1/]	Actual	Production Efficiency[2/]			Primary Objective Visual Quality	Urban Development	
	1964	1964	1980	2000	1980	1980	2020
	(Thousand Acres)						
Land Resource Area 140							
Feed Crop	376.1	381.9	414.8	522.3	351.6	414.8	696.1
Food Crop	47.0	9.3	9.2	9.3	37.6	9.3	28.3
Hay	1,145.6	4,782.4	2,722.9	2,044.1	1,098.8	2,722.9	3,826.8
Pasture	2,229.2	840.1	981.2	1,151.0	1,783.3	981.2	831.0
Pulp	2,297.4	637.9	356.0	1,270.5	1,837.9	338.9	373.9
Sawtimber	4,288.5	460.1	614.9	618.8	3,430.8	599.8	511.0
Other Forest	662.2	662.2	662.2	662.2	662.2	662.2	491.3
Idle	205.6	3,476.9	5,170.3	4,972.5	2,048.3	5,170.3	3,305.4
Land Resource Area 142							
Feed Crop	73.8	254.8	299.6	179.6	70.7	299.6	391.1
Food Crop	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hay	745.5	113.0	74.5	74.5	529.3	74.5	74.5
Pasture	973.7	389.5	453.9	468.6	724.0	453.9	531.3
Pulp	481.5	1,190.0	896.6	947.1	411.0	894.6	784.6
Sawtimber	640.6	366.1	270.0	333.8	448.4	313.9	311.0
Other Forest	89.7	89.7	89.7	89.7	89.7	89.7	78.0
Idle	16.1	686.9	797.4	996.7	816.8	797.4	551.0
Land Resource Area 143							
Feed Crop	89.9	9.0	9.0	9.0	79.7	9.0	9.0
Food Crop	15.1	2.6	2.6	2.6	12.4	2.6	2.8
Hay	641.3	64.1	64.1	64.1	513.0	64.1	64.1
Pasture	1,127.4	350.6	370.6	370.6	948.9	370.6	370.6
Pulp	3,926.3	7,073.8	7,114.1	7,114.1	4,542.8	7,048.2	8,303.6
Sawtimber	3,739.3	2,086.8	2,046.6	2,046.6	2,991.3	1,761.1	2,089.1
Other Forest	8,539.0	8,539.0	8,539.0	8,539.0	8,539.0	8,539.0	5,935.5
Idle	78.2	10.5	10.5	10.5	529.1	10.5	10.5
Land Resource Area 144							
Feed Crop	189.7	287.9	208.0	208.0	245.8	208.0	65.1
Food Crop	17.3	9.4	5.2	9.4	16.7	5.2	5.2
Hay	979.5	98.0	98.0	98.0	891.4	98.0	98.0
Pasture	1,319.2	608.6	637.0	800.7	1,204.7	637.0	223.5
Pulp	5,084.6	6,890.9	6,543.6	6,664.1	4,627.0	6,225.0	5,252.6
Sawtimber	3,582.4	1,514.7	1,262.9	1,405.0	3,259.9	1,234.6	1,133.2
Other Forest	2,364.7	2,364.7	2,364.7	2,364.7	2,364.7	2,364.7	2,095.7
Idle	47.9	1,811.3	1,883.1	2,035.0	975.2	1,883.1	417.5

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TABLE G-66

CURRENT AND PROJECTED LAND USE ESTIMATES
CONSISTENT WITH VARYING PLANNING ALTERNATIVES
BY LAND RESOURCE AREAS,
NORTH ATLANTIC REGION

Crop[1/]	Actual	Production Efficiency[2/]			Visual Quality	Urban Development	
					Primary Objective		
	1964	1964	1980	2000	1980	1980	2020
	(Thousand Acres)						
Land Resource Area 145							
Feed Crop	35.9	9.1	6.8	10.8	50.7	6.8	26.1
Food Crop	10.4	14.4	15.8	25.0	12.1	15.8	16.5
Hay	94.3	9.4	9.4	9.4	120.7	9.4	9.4
Pasture	104.0	31.0	14.0	14.0	120.4	14.0	32.6
Pulp	659.4	65.9	65.9	65.9	600.1	65.9	65.9
Sawtimber	194.0	157.3	52.5	72.7	176.6	30.4	45.3
Other Forest	326.4	326.4	326.4	326.4	326.4	326.4	295.2
Idle	4.9	816.5	789.6	905.8	23.3	789.6	480.7
Land Resource Area 146							
Feed Crop	27.3	2.7	2.7	2.7	21.8	2.7	2.7
Food Crop	130.1	223.2	225.8	247.0	134.8	225.8	225.5
Hay	81.7	8.2	8.2	8.2	66.2	8.2	8.2
Pasture	64.2	64.1	57.6	57.7	51.3	57.7	20.3
Pulp	1,772.0	2,677.9	2,894.7	2,702.1	1,796.2	2,820.0	2,293.2
Sawtimber	1,543.1	645.4	440.7	603.7	1,234.5	497.3	1,179.6
Other Forest	504.9	504.9	504.9	504.9	504.9	504.9	330.9
Idle	5.9	2.9	2.9	2.9	319.5	2.9	2.9
Land Resource Area 147							
Feed Crop	988.4	396.5	325.2	359.4	800.4	337.8	477.2
Food Crop	256.3	43.1	86.7	86.7	205.3	86.7	24.0
Hay	807.8	563.2	832.3	1,865.4	704.2	168.3	619.0
Pasture	1,268.6	2,032.2	1,159.1	748.5	1,055.2	1,159.1	1,756.9
Pulp	1,653.8	812.3	446.1	724.7	1,322.8	568.6	455.1
Sawtimber	2,413.5	1,941.6	747.2	607.8	1,930.8	1,229.5	1,279.8
Other Forest	898.7	898.7	898.7	898.7	898.7	898.7	750.8
Idle	96.1	1,695.6	3,577.9	3,092.0	1,465.8	3,577.9	1,112.2
Land Resource Area 148							
Feed Crop	1,065.1	627.3	604.5	520.0	880.4	604.5	604.7
Food Crop	378.0	463.5	396.3	398.2	326.7	396.3	530.1
Hay	1,042.2	1,107.7	2,734.7	1,692.9	948.0	2,734.8	879.7
Pasture	1,589.6	2,634.1	1,437.3	1,608.8	1,271.7	1,438.3	2,256.5
Pulp	2,044.0	602.2	218.5	298.6	1,635.2	236.2	218.6
Sawtimber	2,161.2	1,972.8	216.1	1,614.4	1,729.0	243.3	447.0
Other Forest	633.3	633.3	633.3	633.3	633.3	633.3	267.2
Idle	40.1	921.7	2,091.0	2,187.5	1,529.3	2,091.0	675.7

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TABLE G-66

CURRENT AND PROJECTED LAND USE ESTIMATES
CONSISTENT WITH VARYING PLANNING ALTERNATIVES
BY LAND RESOURCE AREAS,
NORTH ATLANTIC REGION

		Primary Objective					
Crop[1/]	Actual	Production Efficiency[2/]			Visual Quality	Urban Development	
	1964	1964	1980	2000	1980	1980	2020
				(Thousand Acres)			
Land Resource Area 149							
Feed Crop	250.5	554.1	395.8	560.0	206.1	395.8	380.0
Food Crop	595.3	92.1	225.5	508.7	389.7	225.5	144.8
Hay	151.1	15.2	15.2	15.2	120.9	15.2	15.2
Pasture	279.4	536.1	456.7	828.5	223.5	456.7	641.7
Pulp	1,141.6	580.2	114.2	183.2	913.3	188.1	180.8
Sawtimber	1,739.6	1,075.5	195.4	207.2	1,391.7	312.4	174.0
Other Forest	757.1	757.1	757.1	757.1	757.1	757.1	382.2
Idle	32.1	1,126.5	1,744.0	1,676.8	734.4	1,744.0	12.3
Land Resource Area 153							
Feed Crop	400.3	306.1	71.3	87.9	328.7	71.3	268.7
Food Crop	650.8	858.4	658.7	399.7	731.8	658.7	921.1
Hay	63.2	6.3	6.3	6.3	50.5	6.3	99.3
Pasture	155.3	101.3	86.9	109.1	128.0	86.9	187.2
Pulp	459.8	160.2	49.7	61.8	367.9	61.8	102.8
Sawtimber	775.1	351.0	77.5	178.2	620.0	142.2	390.5
Other Forest	155.2	155.2	155.2	155.2	155.2	155.2	118.0
Idle	18.6	739.8	1,686.0	1,680.0	296.0	1,258.3	331.2
NORTH ATLANTIC REGION							
Feed Crop	3,860.3	3,021.2	2,506.1	2,665.3	3,279.4	2,558.2	3,180.7
Food Crop	2,017.1	1,763.1	1,654.7	1,733.7	1,971.8	1,673.1	1,945.1
Hay	6,302.9	6,918.6	5,921.1	5,996.5	5,439.6	6,017.7	6,065.4
Pasture	10,823.6	10,354.7	8,153.1	8,961.3	8,875.9	8,455.9	9,803.8
Pulp	21,953.3	21,984.6	18,974.7	20,746.6	20,254.7	19,150.3	18,751.5
Sawtimber	24,141.3	12,001.7	6,870.4	8,914.5	20,180.2	7,145.6	9,044.5
Other Forest	16,250.0	16,250.0	16,250.0	16,250.0	16,250.0	16,250.0	11,739.5
Idle	589.0	13,614.8	25,577.5	20,640.8	9,748.5	20,229.3	9,093.0
Non-Competing Crops	824.4	824.4	1,157.0	1,237.0	1,157.0	1,157.0	1,413.0

1/ Feed crops include corn grain, corn silage, grain sorghum, oats, barley and grass silage.
Food crops include wheat, rye, soybeans and potatoes.
Pasture includes grazed forest.
Other forest includes seedlings and saplings.
Non-Competing crops are vegetables, fruits, tobacco, peanuts and sweet potatoes.

2/ While production efficiency is the primary factor in land use projections in these columns, the land use estimates are also affected by the constraints and assumptions discussed on pages

Sheet 4 of 4

TABLE G-67

PERCENTAGE DISTRIBUTION OF LAND
NEEDED TO MEET PROJECTED PRODUCTION
BY LAND RESOURCE AREAS
1980 EFFICIENCY RUN
NORTH ATLANTIC REGION

Land Resource Area	Cropland	Pasture	Forest	Idle	Other
			(Percent)		
127	4.0	2.0	26.0	47.0	21.0
128	4.0	40.0	15.0	21.0	20.0
133	12.0	7.0	15.0	28.0	38.0
136	1.0	16.0	20.0	33.0	30.0
140	24.0	3.0	12.0	40.0	21.0
142	4.0	4.0	22.0	23.0	47.0
143	0.5	1.0	79.0	0.1	19.0
144	3.0	4.0	58.0	13.0	22.0
145	4.0	0.5	24.0	50.0	21.0
146	6.0	1.0	87.0	0.1	6.0
147	15.0	11.0	23.0	42.0	9.0
148	29.0	22.0	11.0	27.0	11.0
149	13.0	7.0	15.0	35.0	30.0
153	15.0	2.0	6.0	35.0	42.0

TABLE G-68

ACREAGE NEEDED TO MEET PROJECTED PRODUCTION
BY LAND RESOURCE AREAS
1980 EFFICIENCY RUN
NORTH ATLANTIC REGION

Land Resource Area	Cropland	Pasture	Forest	Idle	Other 1/
			(Thousands)		
127	250.5	125.2	1,465.6	2,638.9	1,152.1
128	168.7	1,636.0	638.5	878.5	808.7
133	76.8	46.1	91.6	171.8	236.0
136	22.9	310.8	406.8	651.6	597.2
140	3,420.8	400.4	1,661.1	5,795.8	3,119.5
142	248.1	251.4	1,282.3	1,316.2	2,711.0
143	105.5	334.2	17,735.9	10.5	4,247.1
144	468.5	791.9	10,200.9	2,251.2	3,868.3
145	75.0	10.2	448.7	926.0	400.5
146	246.2	56.6	3,841.5	2.9	242.1
147	1,410.8	1,028.9	2,117.7	3,958.3	801.3
148	2,922.0	2,306.6	1,097.2	2,785.1	1,112.8
149	934.3	521.3	1,072.4	2,504.6	2,171.6
153	748.3	84.6	284.7	1,686.0	2,053.0
TOTAL	11,098.4	7,904.2	42,344.9	25,577.4	23,521.2

1/ Land for urban, roads, parks and other public use.

As would be expected, cropland moved into the more productive Soil Resource Groups. Ninety percent of the land allocated to crop production in the efficiency run is in capability classes I, II and III (SRG's 101, 211, 221, 231, 311, 321 and 221). (Table G-69). Nearly 50 percent of all cropland is in SRG-211 (IIe).

Approximately 70 percent of the pasture is concentrated in IIIe, IVe, and the V through VIII capability classes. Only about 1 percent of pasture is located on capability classes I and II. (Table G-70).

For land utilized in forest production, the distribution by percent of Soil Resource Groups shows only a slight weighting towards the less productive Soil Resource Groups. A similar trend is indicated for idle land.

As mentioned earlier, land needs for vegetable and fruit production would be evaluated outside the model. There will be additional needs for 333,600 acres for vegetable and fruit crops in the Region by 1980. In light of the previous discussion of forest and idle allocation, there would seem to be enough class I land alone to meet this need, not to mention 3 million acres in SRG 211 that would also be available.

Urban and Other Development. The initial 1980 efficiency run did not assign additional land for urban and associated types of development. An additional run was made incorporating a simulation of this type of development so that comparison could be made with the efficiency run.

It appears that the introduction of the projected Urban and Other development for 1980 did not have a significant impact on the Region's production capacity. The increase in total Regional production costs was $11.4 million, or only 1.8 percent. The increase in opportunity cost average $2.58 per acre for the 4.4 million acres developed.

Table G-71 presents the changes in marginal costs for specific crops that are caused by introducing development. Rye increased by only $0.03 per unit, corn, oats and potatoes by $0.01, pasture by $0.02, and hay by $0.69. As more and more land is removed in this pattern, costs increase significantly. Initially, much of the land shifts in the model occurred in the lower value crops. As more acreage is introduced for development in the more productive soils beyond 1980, more land shifts will occur in the higher value crops, causing more significant increases in costs. This is indicated by the data in Table G-72 which show large shifts in hay and pasture crops to less productive Soil Resource Groups. A net increase of 906,800 acres over the 1980 efficiency run is needed to meet the demand for food and fiber. Only 70,400 additional acres will be needed for the higher value agricultural crops in 1980.

As mentioned in the analysis of the efficiency run, consideration must be given to the crops that have not been budgeted to compete in the model (vegetables, fruits, tobacco, peanuts and sweet potatoes).

TABLE G-69

PROJECTED LAND USE
BY SOIL RESOURCE GROUPS
1980 EFFICIENCY RUN
NORTH ATLANTIC REGION

Land Resource Group	Cropland	Pasture	Forest	Idle	Other 1/
			(Thousands)		
101	928.4	27.9	503.5	40.7	537.2
211	5,283.1	476.9	3,139.5	153.2	3,021.0
221	1,121.5	390.7	1,141.8	872.0	966.1
231	184.0	75.5	857.9	394.5	591.0
311	1,803.4	2,147.3	1,908.3	1,465.0	2,213.9
321	535.1	870.0	843.8	2,311.7	1,348.8
331	111.7	128.5	1,513.1	643.6	815.9
411	847.9	1,563.9	1,156.8	1,706.8	1,202.0
421	139.4	67.4	934.3	964.4	630.8
431	22.7	289.8	703.7	653.6	777.5
601	121.2	1,865.5	29,642.2	16,371.9	6,746.9
702 2/	-	-	-	-	4,670.1
TOTAL	11,098.4	7,904.2	42,344.9	25,577.4	23,521.2

1/ Land for urban, roads, parks, and other public use.
2/ This SRG is water surface acres.

TABLE G-70

PERCENTAGE DISTRIBUTION OF LAND
NEEDED FOR PROJECTED PRODUCTION
BY SOIL RESOURCE GROUPS
1980 EFFICIENCY RUN
NORTH ATLANTIC REGION

Soil Resource Group	Cropland	Pasture	Forest	Idle	Other
			(Percent)		
101	46.0	1.0	25.0	2.0	26.0
211	44.0	4.0	26.0	1.0	25.0
221	25.0	9.0	25.0	19.0	22.0
231	9.0	3.0	41.0	19.0	28.0
311	19.0	23.0	20.0	15.0	23.0
321	9.0	15.0	14.0	39.0	23.0
331	4.0	4.0	47.0	20.0	25.0
411	13.0	24.0	18.0	26.0	19.0
421	5.0	3.0	54.0	35.0	23.0
431	1/	12.0	29.0	27.0	32.0
601	1/	4.0	54.0	30.0	12.0

1/ Less than .5 percent.

TABLE G-71

DIFFERENCES IN MARGINAL COST PER UNIT
FOR SELECTED CROPS BETWEEN THE
1980 EFFICIENCY RUN AND 1980 DEVELOPMENT RUN
NORTH ATLANTIC REGION

Crop	Unit	Efficiency Run	Development Run	Difference
			(Dollars)	
Rye	Bu.	.86	.89	.03
Corn Grain	Bu.	.52	.53	.01
Corn Silage	Ton	3.89	3.89	.00
Oats	Bu.	.53	.54	.01
Hay	Ton	12.93	13.63	.69
Soybeans	Bu.	1.22	1.22	.00
Potatoes	Cwt.	.93	.94	.01
Pasture	AUD	.13	.15	.02

TABLE G-72

CHANGES IN LAND USE
BY SOIL RESOURCE GROUP
1980 EFFICIENCY RUN to 1980 DEVELOPMENT RUN
NORTH ATLANTIC REGION

Soil Resource Group	Non-Hay Crops	Hay Crops	Pasture	Forest	Idle	Net Change
			(Thousand Acres)			
101	-57.2	-11.5	-4.8	-78.6	-4.1	-156.2
211	-265.1	-1,097.2	-93.1	-194.2	-101.9	-1,751.4
221	66.6	-4.0	-6.0	49.1	-259.0	-153.3
231	-8.0	0.0	-22.8	149.3	-386.8	-268.3
311	9.0	1,218.0	-1,100.9	442.4	-1,314.4	-754.9
321	332.9	-8.7	-12.8	-19.0	-446.8	-154.4
331	0	0	18.4	-115.4	-291.8	-388.8
411	2.3	0	43.0	153.9	-413.7	-214.5
421	-1.1	0	409.5	12.8	-420.9	0.3
431	0	0	316.1	95.8	-464.9	-53.0
601	0	0	755.2	-58.1	-1,243.9	-546.8
NET	70.4	96.6	301.8	438.0	-5,348.2	-4,441.4

More than 80 percent of these crops produced in the North Atlantic Region are grown in LRA's 144, 147, 148, 149 and 153. These Land Resource Areas alone, in the optimal solution, contain more than 2.7 million acres of idle land in capability classes I through IV. This is not to mention large acreages in lower value crops which would be shifted to less productive Soil Resource Groups should the land be needed for these specialty crops. For the Region, the solution contains 9.4 million underutilized acres in classes I and II. Therefore, with this amount of land in the more productive classes and at a low intensity use, there is sufficient good quality land to meet the additional demand for 333,600 acres by 1980 for the production of high-value crops.

Visual Quality. In recent years, much concern has been expressed about our deteriorating environment. Movement of our economy toward economic efficiency (equilibrium) is not necessarily complementary to a desirable or pleasing environment. This is especially true in the development of our land and water resources. As land use patterns move toward an economically efficient allocation, the visual environment loses much of its elegance. This section of the analysis substantiates this difference and assigns an opportunity cost to the achievement of a quality environment.

Table G-73 presents a comparison of land use patterns between the 1980 visual quality and the efficiency objectives by Land Resource Areas. The "Open" category represents the acres of cropland and pasture that are required to meet the two objectives. It is noted that the total "Open" acres required in the Region are only slightly larger for the visual quality run than for the efficiency run. However, the difference between Land Resource Areas is much greater.

The forested acres necessary to meet the specified requirements differ considerably between the visual quality run and the efficiency run. In order to satisfy the visual quality constraints in the Region, the total forest acres needed to meet requirements over the efficiency solution increased considerably.

Additional water surface area needed to fulfill the visual quality constraint was approximately 16 percent. All of the increase is in the southern Land Resource Areas in the Region with the exception of LRA 140. This is indicative of an environmental deficiency in this general area of the NAR.

Table G-74 compares efficiency run production costs per acre with production costs under visual quality constraints. The Regional production cost is $4.34, or 69 percent higher, with the visual quality assumptions. This figure indicates that the opportunity cost in terms of food and fiber production would increase on the average 69 percent if the most desirable pattern of visual quality were achieved in the Region.

The differences among Land Resource Areas range from -$5.26 per acre in LRA 146 to $15.95 per acre in LRA 136. The negative cost in LRA 146 is obtained because the efficiency run placed a larger

TABLE G-73

LAND USE AND WATER SURFACE
BY LAND RESOURCE AREA
1980 VISUAL QUALITY VERSUS 1980 EFFICIENCY
NORTH ATLANTIC REGION

Land Resource Area	OPEN 1/ Visual Quality	OPEN 1/ Efficiency	FOREST Visual Quality	FOREST Efficiency	WATER Visual Quality	WATER Efficiency
	(Thousand Acres)					
127	375.9	375.5	3,822.9	1,465.6	225.1	23.8
128	846.7	1,804.6	1,892.7	638.5	91.1	9.1
133	118.7	294.8	216.7	91.6	24.8	6.8
136	382.4	333.7	943.4	406.8	79.5	9.0
140	2,971.1	3,821.1	6,258.7	1,661.1	335.9	186.6
142	1,964.3	499.5	1,130.7	1,282.3	351.0	351.0
143	1,293.0	439.7	16,364.0	17,735.9	1,169.6	1,169.6
144	2,215.1	1,260.4	10,522.2	10,200.9	1,317.4	1,317.4
145	298.8	85.2	1,137.8	448.7	71.6	71.6
146	283.0	302.8	3,544.6	3,841.5	83.2	83.2
147	2,692.5	2,439.8	4,357.5	2,117.6	88.0	88.0
148	3,350.2	5,228.6	4,231.3	1,097.2	409.1	177.9
149	1,190.1	1,445.6	3,108.2	1,072.4	730.9	730.9
153	1,346.3	832.9	1,161.2	284.7	445.2	445.2
TOTAL	19,328.1	19,164.4	58,697.9	42,344.9	5,422.2	4,670.0

1/ Cropland and Pasture.

TABLE G-74

COMPARISON OF PRODUCTION COSTS PER ACRE
BY LAND RESOURCE AREA
1980 EFFICIENCY RUN VERSUS 1980 VISUAL QUALITY RUN
NORTH ATLANTIC REGION

Land Resource Area	Acre/Cost Efficiency	Acre/Cost Visual Quality	Acre/Cost Difference
		(Dollars)	
127	2.57	7.28	4.71
128	5.56	11.55	5.99
133	5.65	16.66	11.01
136	3.51	19.46	15.95
140	6.56	8.34	1.78
142	3.53	5.82	2.29
143	3.89	4.66	.77
144	5.72	9.34	3.62
145	5.47	14.40	8.93
146	22.47	17.21	-5.26
147	5.86	12.43	6.57
148	10.29	18.73	8.44
149	6.50	17.16	10.66
153	6.71	17.22	10.51
AVERAGE - NAR	6.32	10.66	4.34

proportion of the potato acreage in that Land Resource Area, while the visual constraints did require that some of these potatoes be grown elsewhere in the Region. Since potato production has the highest per acre cost of any crop considered, the total production costs in the Land Resource Area were reduced with the visual quality constraint, even though the Regional average cost was increased by this shift.

Results for 2000

Efficiency. There are primarily two variations in the model inputs between the runs for 1980 and 2000. The first was the change in production that will be needed to meet the Region's projected share. These new requirements appear in Table G-62. The second input variation were yields and fertilizer applications for 2000. Yields were projected by target year. Fertilizer need variations are a function of yield projections. Other constraints were identical to those used in the 1980 efficiency run.

In order to meet the projected level of production for the target year 2000, production costs increased over the 1980 run by $125.6 million or approximately 18 percent. Per acre costs increased by $1.83.

The percent increase in marginal production costs ranged from minus 1 percent for pasture to 14 percent for soybeans. In this case, marginal production costs are defined as the production cost per unit on an additional acre of a given crop. Thus, by adding an additional acre of soybeans in the 2000 run, the cost per bushel is 14 percent higher than for an additional acre in 1980.

The additional land needed to meet feed and food crop requirements from 1980 to 2000 will be 238,000 acres, up less than 2 percent from 1980. (Table G-75). Hay production will require an additional 75,400 acres. In addition, more than 808,200 additional acres will be needed for pasture requirements. A portion of the pasture can be grown on classes V to VIII. (Approximately one-third of the Region's pasture in 1964 was in these classes).

In determining land needs, it is also necessary to consider the increased needs for the model's non-competing activities. These non-competing activities include the specialty crops (vegetables, fruits, tobacco, sweet potatoes and peanuts) and urban-other development. Since these activities did not compete for land in the 1980 run, it is necessary to enter total land needs from 1964 to 2000 rather than just the difference from 1980 to 2000. The specialty crops will require a total of 413,600 acres to meet projected production.

From the data on page G-177, there will be a need for approximately 4,863,000 acres of land for Urban development in 2000. Following the 1980 assumption for Other, i.e., one acre of Other for each acre of Urban, the total acreage needed for both categories will be 9,726,000 acres.

TABLE G-75

ADDITIONAL ACREAGE NEEDED TO MEET SPECIFIED ITEMS
1980 - 2000 EFFICIENCY RUN
NORTH ATLANTIC REGION

Item	Additional Acres Needed in 2000
	(Thousand Acres)
Feed Crop	159
Food Crop	79
Hay	75
Pasture	808
Pulp	1,772
Saw	2,044
Specialty Crops 1/	414
Urban and Other 1/	9,726 2/
TOTAL	15,077

1/ Items are for 1964 to 2000.
2/ Acreage obtained from Table for Urban Land and doubled to estimate Urban and Other development.

TABLE G-76

IDLE LAND
BY LAND RESOURCE AREA AND LAND CAPABILITY CLASSES
2000 EFFICIENCY RUN
NORTH ATLANTIC REGION

Land Resource Area	Classes I-IV	Classes V-VIII	Total
		(Thousand Acres)	
127	347	1,861	2,208
128	113	1/	113
133	88	71	159
136	234	367	601
140	1,115	3,856	4,971
142	310	686	996
143	1/	10	10
144	227	1,808	2,035
145	296	610	906
146	1/	3	3
147	351	2,741	3,093
148	866	2,102	2,188
149	855	822	1,677
153	1,336	345	1,681
TOTAL	5,358	15,282	20,640

1/ Less than 100 acres.

Table G-76 indicates the allocation and classes of idle land in the Region under the assumptions of the 2000 run. It is noted that the less productive soils contain nearly two-thirds of the idle land while less than one-third will be in capability classes I through IV. There will also be a 19 percent reduction of idle land from 1980 to 2000.

In general, there will be enough land for food and fiber production, urban and other development in target year 2000. The additional acreage of feed crops, food crops, hay, pasture, pulpwood and sawtimber have already been accounted for in the optimum solution. However, there will be a need for 10,140,000 acres for urban development and specialty crops. These have not been accounted for in the model. In view of the fact that there are more than 20 million acres of idle land in the optimal solution, the assumption is that the projected production could be attained from the land resources in the Region.

Land Use Analysis and Planning Opportunities.

Subjective evaluation of the results to this point indicate that additional implications about alternative situations can be obtained from the basic runs without the added cost of running the model many times.

Efficiency. In analyzing remaining productive capacity, it is necessary to consider not only idle land by Soil Resource Groups, but also the amount of forest land allocated to the lower capability Soil Resource Groups. In its pursuit of the least-cost optimal solution, the model has created a built-in bias for allocating idle land in the less productive Soil Resource Groups. Projected production of agricultural products could be attained on land in the better Soil Resource Groups. Since projected forest production must also be subjected to the least-cost criterion, the land in the better Soil Resource Groups was assigned to forest production because production costs are lowest there. Thus, idle land is available in greater acreage, but is forced into the less productive Soil Resource Groups. As agricultural production is increased, forest production could be shifted to less productive Soil Resource Groups. However, due to the long term nature of wood production (30 to 100 years), short term shifts among Soil Resource Groups are impractical.

Urban and Other Development. The 2000 efficiency run simulates a land use pattern that would develop if the Region were zoned to force urbanization on land classes V through VIII. This zoning restriction is, of course, considered the extreme type of policy alternative to conserve land for agricultural production. Under these conditions, there would be no shortage of land resources to meet the projected production. Indeed, due to underutilization of the more productive land, a considerable shift of forest production would move into the more productive Soil Resource Groups to satisfy the least-cost criterion. There would be a requirement for approximately 9.7 million acres for urbanization while more than 15 million acres of idle land have been allocated to classes V through VIII in the efficiency run.

However, since the above zoning assumption would not likely be an acceptable alternative at this time, it is necessary to look at a more realistic type of pattern. Historically, slightly more than 85 percent of the land urbanized comes from land classes 1 through IV. If this development pattern continues, the projected production could be achieved in 2000, but at a considerable increase in cost over the efficiency solution. Table G-76 shows that as a result of the efficiency run, there would be a total of 20.6 million acres of idle land in 2000. However, only 5.4 million acres would be in capability classes I through IV and the remaining 15.3 million acres would be in classes V through VIII. Approximately 9.7 million additional acres1/ will be needed in classes I through IV to meet the needs outlined in Table G-75. Thus, it appears there would be a deficiency of acreage in classes I through IV to meet the specified needs. However, this land requirement could be met in 2000 from the substantial acreage of idle land in capability classes V through VIII. Also, there are nearly 13 million acres of pulp and sawtimber acreage in classes I through IV in the efficiency solution. Urbanization could pre-empt the forest land on classes I through IV, causing its shift into the lower capability classes.

Due to the time period required to produce marketable forest products, this shift into the lower classes would occur only in a long-run situation. In addition, since forest is a residual use, land in forest is not likely to decline in classes V through VIII unless the land is needed for other uses. Thus, if large acreages of idle land become available in the short-run situation, they would appear in the capability classes I through IV rather than in V through VIII.

Visual Quality. The inefficiencies inherent in the Region's current land use patterns could provide a rare opportunity for policy decisions to be used to achieve a desired non-economic objective and, at the same time, increase the efficiency of land allocation over the current use. It is evident that the optimal land use pattern for meeting the visual quality objective lies somewhere between the current pattern and the efficiency allocation. Therefore, during the progression toward economic efficiency, the patterns of land use may closely approximate the visual quality optimum at some point in time. At this point, it should be necessary to determine whether the maintenance of visual quality is worth the cost in ultimate efficiency. If so, the necessary planning decisions should be implemented to preserve the desired level of visual quality.

The additional water surface acreages that are required in some areas to satisfy the visual quality constraints are not likely to evolve in the normal progression of economic activity. Additional planning decisions are needed to obtain this objective.

1/ This is 85 percent of urban requirement plus all acres needed for specialty crops.

Trend Projections.

Preliminary projections of the Region's land use were prepared by Area and Subregion. These were based on time series analysis (historical trends) and ignored future demands for food and fiber. These preliminary projections and methodology are in addition to the linear programming analysis. The resulting data served as guides to future land use during the study and provided comparison data to evaluate the relevancy of the linear programming runs.

Historical data series were not available on a consistent basis for all land uses and in all areas. Agricultural Census data series by county were available for three land use categories—Cropland, Pasture, and Other. Also, the 1958 Conservation Needs Inventory shows all land use categories which provided a base for projection of the above three categories in relation to available land.

In general, it was noted that agricultural land use has been decreasing, but the rate of decline has been slowing. The initial rate of decrease was faster because the most inefficient farms were eliminated by technology at the outset. The farms that remain are more efficient and have a higher probability of remaining in competition. An exponential curve provided the best "fit" to this type of data. The curve was fitted to the land in farms and the appropriate values obtained for the target years.

The projected acreages of forest land were based on various studies of forest acreages made by the Forest Service, USDA. Urban land requirements per capita were based on recent studies of urban area growth and population changes and were used to determine future urban land requirements.

Since future land requirements for the various uses could not exceed the land base, adjustments had to be made in the projections to add to 100 percent. Greater adjustments were made in the "Other" land use category since the information available was considered less reliable than on the remaining land use categories.

Tables G-77 through G-80 show the results of these projections based on the time series data.

An inspection of these data indicates that cropland would decline from approximately 15.2 percent of the total area in 1964 to 11.4 percent in 1980 and to 6 percent in 2020. These declines are noticeably greater in the northermost subregions and in areas that presently have large amounts of urban land. The pasture projections were proportionately similar to those of cropland with the greatest declines in the northern subregions. The total percentage of forest acreage remained about the same, but there were some significant shifts between the subregions. Subregions B and D had a considerable decline in acreage, while C and E showed substantial gains.

Urban and Other land is estimated to more than double by 2020.

TABLE G-77

PRESENT LAND USE, FARM, AND NON-FARM, AS A PERCENTAGE OF TOTAL LAND AREA, 1964

Subregion and Area	Farm 1/ Crop-land	Pas-ture	Forest	Other 2/	Non-Farm Urban	Forest	Other 3/
	(Percent)						
Subregion A							
1	5.2	0.6	5.0	.7	0.8	87.7	4/
2	3.9	0.8	3.8	.3	1.9	88.3	1.0
3	8.0	2.0	7.9	.7	2.7	78.7	4/
4	6.2	1.2	8.2	.4	4.1	78.6	1.3
5	6.2	0.4	9.5	1.5	3.6	76.3	2.5
Average A	5.7	1.0	6.4	.7	2.3	83.0	.9
Subregion B							
6	6.9	1.4	8.9	.7	5.8	70.8	5.5
7	5.5	1.9	7.6	.8	8.9	70.0	5.3
8	8.6	4.9	10.1	.8	3.7	68.8	3.1
9	5.5	2.3	4.9	2.0	19.8	56.8	8.7
10	8.4	5.7	7.4	1.7	8.9	60.9	7.0
Average B	7.4	3.6	8.3	1.1	8.0	66.3	5.3
Subregion C							
11	17.1	12.9	8.2	1.5	1.9	53.8	4.6
12	15.6	8.5	6.0	2.1	4.7	56.8	6.3
13	6.0	.4	.9	1.1	52.0	33.4	6.2
Average C	15.6	9.9	6.6	1.8	6.5	54.0	5.6
Subregion D							
14	15.6	3.1	2.1	1.4	30.4	37.9	9.5
15	22.7	5.8	6.5	2.6	10.0	44.4	8.0
16	15.1	1.5	1.9	1.4	14.5	52.0	13.6
Average D	20.8	4.8	5.3	2.3	13.4	44.5	8.9
Subregion E							
17	23.1	8.5	8.5	2.4	5.1	47.6	4.8
18	37.8	4.5	12.0	2.8	4.9	25.5	12.5
Average E	26.2	7.6	9.2	2.5	5.1	43.0	6.4
Subregion F							
19	19.7	12.4	12.3	2.0	4.0	44.8	4.8
20	15.6	9.6	14.5	1.3	3.1	50.8	5.1
21	9.6	8.0	15.1	1.1	5.2	58.9	2.1
Average F	15.4	10.4	13.7	1.6	4.3	50.7	3.9
Regional Average	15.2	6.3	8.6	1.6	6.0	57.4	4.9

TABLE G-78

PROJECTED LAND USE, FARM, AND NON-FARM, AS A PERCENTAGE OF TOTAL LAND AREA, 1980

Subregion and Area	Farm 1/ Crop-land	Farm 1/ Pas-ture	Farm 1/ Forest	Farm 1/ Other 2/	Non-Farm Urban	Non-Farm Forest	Non-Farm Other 3/
	(Percent)						
Subregion A							
1	4.3	.3	3.6	.5	.8	89.0	1.5
2	1.3	.3	2.2	.2	1.9	92.3	1.8
3	2.7	.8	4.3	.4	2.7	87.5	1.6
4	3.0	1.2	6.6	.3	4.1	83.1	1.7
5	2.3	.6	4.6	.7	3.7	84.3	3.8
Average A	2.7	.6	3.9	.4	2.4	88.0	2.0
Subregion B							
6	3.4	1.0	4.8	.4	6.0	79.2	5.2
7	2.8	1.5	3.9	.3	13.2	70.7	7.6
8	4.3	3.3	5.6	.3	6.7	74.4	5.4
9	3.5	.9	3.2	1.2	25.1	55.3	10.8
10	4.8	3.2	3.9	.8	15.8	62.3	9.2
Average B	3.9	2.3	4.6	.5	11.8	69.7	7.2
Subregion C							
11	11.8	10.2	5.7	.8	1.9	64.3	5.3
12	11.8	5.5	3.8	1.1	5.1	66.2	6.5
13	1.5	.2	.4	.4	62.2	14.6	20.7
Average C	11.2	7.2	4.4	.9	7.4	61.8	7.1
Subregion D							
14	7.5	1.1	1.2	.7	48.4	33.8	7.3
15	17.0	4.8	4.4	1.5	11.8	45.6	14.9
16	7.0	.4	1.4	.9	16.0	56.6	17.7
Average D	14.5	3.7	3.6	1.3	17.3	45.4	14.2
Subregion E							
17	19.0	7.8	7.2	1.6	6.0	52.8	5.6
18	27.7	3.4	9.4	1.8	14.9	34.6	8.2
Average E	20.8	6.9	7.7	1.7	7.9	48.9	6.1
Subregion F							
19	18.1	13.0	9.4	1.1	7.0	48.6	2.8
20	12.7	7.2	12.3	.8	3.3	55.7	8.0
21	8.9	9.0	11.6	.5	5.4	63.4	1.2
Average F	14.0	10.6	10.7	.9	5.7	54.9	2.2
Regional Average	11.4	5.4	6.1	1.0	8.1	62.2	5.7

TABLE G-79

PROJECTED LAND USE, FARM, AND NON-FARM, AS A PERCENTAGE OF TOTAL LAND AREA, 2000

Subregion and Area	Farm 1/ Crop-land	Farm 1/ Pas-ture	Farm 1/ Forest	Farm 1/ Other 2/	Non-Farm Urban	Non-Farm Forest	Non-Farm Other 3/
	(Percent)						
Subregion A							
1	2.9	.1	2.1	.3	.9	91.8	1.9
2	.6	.1	1.0	.1	1.9	94.0	2.3
3	1.5	.4	2.3	.2	2.7	90.1	2.8
4	1.7	.6	3.6	.2	4.2	86.9	2.8
5	1.6	.4	3.0	.5	3.8	86.2	4.5
Average A	1.6	.3	2.2	.3	2.4	90.4	2.8
Subregion B							
6	1.6	.4	2.1	.2	8.1	79.9	7.7
7	1.2	.6	1.4	.1	17.7	70.1	8.9
8	2.3	1.7	2.8	.1	9.0	77.2	6.9
9	1.9	.5	1.6	.6	33.7	47.3	14.4
10	2.3	1.4	1.7	.3	21.1	61.5	11.7
Average B	2.0	1.1	2.2	.2	15.9	69.4	9.2
Subregion C							
11	8.3	7.0	3.7	.3	2.2	70.8	7.7
12	8.1	3.7	2.5	.6	6.0	72.5	6.6
13	0	0	.1	.1	73.1	4.9	21.8
Average C	7.7	4.9	2.9	.5	8.6	67.4	8.0
Subregion D							
14	3.5	.5	.5	.3	63.8	25.7	5.7
15	11.6	3.2	2.8	.8	15.5	42.2	23.9
16	6.0	.2	.7	.4	21.1	54.3	17.3
Average D	9.8	2.5	2.2	.7	22.8	41.5	20.5
Subregion E							
17	14.8	5.9	5.3	1.0	8.5	59.6	4.9
18	21.5	2.6	7.0	1.0	21.3	38.0	8.6
Average E	16.2	5.2	5.7	1.0	11.2	55.0	5.7
Subregion F							
19	14.1	9.8	7.0	.5	9.6	52.0	7.0
20	9.4	5.1	8.6	.3	4.6	61.4	10.6
21	6.3	6.0	7.7	.1	7.5	68.3	4.1
Average F	10.6	7.6	7.6	.3	7.9	59.2	6.8
Regional Average	8.2	3.8	4.0	.5	10.6	65.1	7.8

TABLE G-80

PROJECTED LAND USE, FARM, AND NON-FARM, AS A PERCENTAGE OF TOTAL LAND AREA, 2020

Subregion and Area	Farm 1/				Non-Farm		
	Crop-land	Pas-ture	Forest	Other 2/	Urban	Forest	Other 3/
	(Percent)						
Subregion A							
1	1.8	4/	1.2	.2	1.0	92.7	3.1
2	.3	4/	.4	4/	1.9	94.4	3.0
3	.8	.2	1.2	.1	2.7	91.1	3.9
4	1.0	.3	2.0	.1	4.2	88.5	3.9
5	.9	.2	1.6	.3	3.9	87.4	5.7
Average A	1.0	.1	1.2	.1	2.5	91.4	3.7
Subregion B							
6	.7	.1	.9	.1	11.2	77.1	9.9
7	.5	.2	.5	4/	24.7	63.1	11.0
8	1.2	.8	1.3	4/	12.5	73.6	10.6
9	1.0	.2	.8	.3	47.0	31.0	19.7
10	1.1	.6	.8	.1	29.5	54.0	13.9
Average B	1.0	.5	1.0	.1	22.1	62.9	12.4
Subregion C							
11	5.9	4.6	2.4	.2	2.6	74.5	9.8
12	5.6	2.4	1.5	.4	7.2	74.3	8.6
13	0	0	.1	.1	78.0	2.9	18.9
Average C	5.4	3.2	1.8	.3	9.8	69.8	9.7
Subregion D							
14	1.6	.2	.2	.1	75.8	18.2	3.9
15	7.9	2.1	1.7	.5	20.8	38.2	28.8
16	5.0	.1	.3	.2	28.2	49.6	16.6
Average D	6.7	1.6	1.3	.4	29.2	37.0	23.8
Subregion E							
17	11.6	4.3	3.8	.6	12.7	61.2	5.8
18	16.8	1.9	5.1	.7	31.8	34.9	8.8
Average E	12.7	3.8	4.1	.7	16.7	55.6	6.4
Subregion F							
19	11.1	7.3	5.0	.3	13.8	53.0	9.5
20	6.9	3.5	5.9	.1	6.6	64.1	12.9
21	4.5	4.0	5.0	4/	10.8	69.0	6.7
Average F	8.0	5.5	5.2	.2	11.4	60.5	9.2
Regional Average	6.0	2.6	2.6	.3	14.3	64.4	9.8

1/ Land in farms, as defined by U. S. Census of Agriculture consists of all agricultural land used for crops or grazing plus acreages of woodland and wasteland owned or rented by farm operators unless being held for non-agricultural purposes.
2/ Land in farms devoted to house lots, barn lots, lanes, roads, ditches, ponds, and wasteland.
3/ Includes rural non-farm residences, country churches and school grounds, tracts of open, idle rural non-farm land, etc.
4/ Less than .1 percent.

Small watershed structure combined with a state park provides camping, fishing and beach area. Interstate highway and airport provides easy access.

This is true in all subregions except "A" where only a slight increase is indicated, and Subregion C where the increase is sizeable. The most urbanized subregion will be Subregion D in 2020 where 29 percent of the land is estimated to be used for urban purposes. Some of the areas are estimated to be used almost entirely for urban purposes by 2020. These are Area 14 (the Passaic and the Raritan River Basins) and Area 13 (the New York-Long Island Area).

Trend and Linear Programming Comparisons.

The trend or time series projections reflect the most likely land use pattern assuming the continuation of current trends; whereas, the linear programming analysis of alternatives reflects probable land use patterns assuming increased mobility of resources and a concerted effort to better manage our land resources. The former answers what will happen without sound planning, while the latter provides a range of patterns given the several selected objectives. Comparison of the two analytical techniques illustrates possible land use differences and provides interesting policy implications.

It should be noted that if present trends continue, food and fiber production deficits would result, requiring increased imports from other regions. The resulting land use patterns indicate that cropland would decline to approximately 11 percent and land in forest would decline to 62 percent by 1980. Cropland would further reduce to 6 percent by 2020 with forest regaining to approximately 64 percent. The above production deficits would not be evidenced, however, should the resources required to meet regional production requirements become freed from their present institutional rigidities. On the other land, the linear programming analysis indicates that projected crop production could be met on only 10 percent of the Region and projected wood products could be met on fewer acres of forest land given adoption of more efficient production methods.

The above comparisons consider land needs for food and fiber production, urban and other requirements as single uses only. As land is shifted from one use to another, it often is held more for speculation than for productive purposes. "In order to fully use our land resources for all the people, the concept of idle acres (must) be supplanted with a concept of creative acres....these acres are one of our greatest assets. We should make the maximum use of interim retired acres through reforestation, game cover, recreation, and conservation. High priority should be given to additional parks, greenbelts, and intermediate recreational areas."(18) When consideration is given to multiple use of the land resource, then land management must include provision for elements such as recreation, wildlife, and aesthetics as well as management for food and fiber production.

Visual quality requirements indicate 19 percent of the Region should remain in open space; whereas, the trend projection indicates less than 17 percent will remain in crop and pasture in 1980 and will decline to less than 9 percent by 2020. Again, this gives indication of the potential problems which will arise without the benefit of sound land use planning on a regional basis.

Summary.

Comparison of the trend projections and the linear programming analysis of alternative land use patterns provides insight concerning the capability of the land to satisfy the many requirements placed upon it while highlighting the problems of competing use of specific land resources. Multiple use provides the opportunity for the production of food and fiber while simultaneously providing other services in great demand. However, management and planning become more complicated as a result. Thus, the array of alternatives displayed in Table G-81 provides a greater selection to develop policies and programs to increase returns from the limited land resource base.

Closer examination of this array reveals cropland declining from the present situation for all planning alternatives displayed. Pasture decreases with the historical trend but increases with all other planning alternatives; whereas, forest remains relatively constant considering continuation of current trends while decreasing in all other cases. Urban and other uses, as expected, increase under all alternatives. The remaining land not required to meet projected production needs for food and fiber is, of course, available to meet the increasing multiple-use needs. However, should projected production of food needs turn out to be too conservative, there is a declining reserve of land suitable for crop production through the year 2020.

The remaining land available which is not needed to meet projected food and fiber needs is not very large when compared to the total land resources of the NAR. In other words, policies and programs must be specifically tailored to society's needs in order to make the most from this disappearing resource. These lands are available for multiple uses weighted heavily toward nonproduction of food and fiber needs; whereas, categories such as cropland must necessarily be weighted more heavily toward production needs even though multiple use can also be made of these lands. In either case, multiple use land management must be increased and improved to insure an enhanced environment while providing society's needs. As the historical trend most vividly shows, open space and land use patterns providing interesting contrasts will disappear without public awareness followed by wise planning and use of the land resources of the NAR.

TABLE G-81

LAND USE PROJECTION SUMMARY
NORTH ATLANTIC REGION

	PATTERNS OF LAND USE CONSISTENT WITH THE PROJECTED DISTRIBUTION OF AGRICULTURAL PRODUCTION					
					Remaining Land 1/	
	Cropland	Pasture	Forest	Urban and Other	Available 2/	Suitable for Cropland 3/
	(Thousand Acres)					
Present (1964)	16,072	6,661	69,786	13,217		
1980						
Efficiency	11,239	8,153	42,095	18,674	25,578	9,206
Urban and Other Development	11,406	8,456	42,546	23,105	20,223	5,160
Visual Quality	11,756	8,876	56,685	18,671	9,748	5,502
Historical Trend	12,054	5,710	72,323	15,649		
2000						
Efficiency	11,553	8,961	45,911	18,671	20,640	5,349
Historical Trend	8,670	4,018	73,064	19,984		
2020						
Urban and Other Development	12,604	9,804	43,847	30,388	9,093	112
Historical Trend	6,344	2,749	70,843	25,780		

1/ All land not accounted for in the first four categories.
2/ Not required to meet projected production needs.
3/ The portion of available land in classes I through IV.

MEANS TO SATISFY NEEDS

Development Opportunities

Land Treatment

Methodologies and Assumptions. Land capability subclasses indidate the dominant problem or hazard and the land is treated according to the problem. The dominant problems on agricultural land are erosion, excess water and unfavorable soil conditions. Basic data for land capability classes and subclasses were provided by the CNI. Present acreages of land adequately treated by land use were taken from CNI data and Agricultural Conservation Program (ACP) Summaries. Table G-82 shows the amount of land requiring treatment by land use for each dominant problem in the Region.

The following assumptions were made regarding cropland treatment demands. For the NE objective 80 percent of soils with erosion and unfavorable soil conditions would be treated with conservation practices by the year 2000 and maintained at that rate through 2020. For the RD and EQ objectives 100 percent would be treated by 2000 and maintained through 2020.

Land use acreages need treatment if they are feasible to treat and are not already treated. Re-treatment is necessary owing to changes in cropping systems or more intensive or changed land use. Accordingly, 10 percent of cropland with erosion and unfavorable soil conditions and pasture require re-treatment in each of the years 1980, 2000 and 2020.

It was assumed for the NE objective that treatment is required on cropland with an excess water problem on classes II and III land. RD and EQ objective needs are somewhat higher. Forests needing drainage are composed of forest types believed profitable to drain from wood products viewpoint only on subclasses IIw through IVw. Other purposes such as wildlife habitat, floodwater storage, ground water recharge, recreation and environmental quality were not considered. All suggested treatment needs for national efficiency are shown in Table G-82.

Forest treatment needs were derived from CNI State Reports and Cooperative Forest Management Accomplishment Reports and adjusted to hydrologic areas. The amount of forest needs to be treated varies considerably with the individual need, ownership pattern, incentives to landowners and regulating agency. Many of the needs are of a recurring nature and treatment goals will be discussed individually under each need.

Installation and technical assistance cost data for forest land treatment measures were derived from PL 534 and PL 566 Watershed Protection and Flood Prevention Programs and from State Reports.

It was assumed that Urban land treatment would affect only transitional land undergoing urban development and will reach a level of 80 percent treatment by 2000 and be maintained at that level in 2020. Expected treatment needs are shown in Table G-82 for the NE objective. Regional Development and Environmental Quality objective needs are somewhat higher.

Agricultural conservation treatment cost data for other than forest were collected for all the NAR states and amount of conservation treatment practices applied was taken from SCS Progress Reports.

Costs for conservation treatment were derived by developing a composite of treatment units needed to control a dominant problem for a specific land use. The treatment units were computed by dividing the amount of acres adequately treated by the amount of the practices reported to control the dominant problem. The results indicate a composite of units of each treatment practice needed to adequately treat one acre. Installation cost per acre was derived by multiplying the units needed for a composite acre by the unit costs. This information is shown on Table G-82.

Costs for technical assistance for other than forest were determined using average costs per acre for developing soil surveys, conservation plans, application time, and consultive service and group planning. SCS reports of expenditures and of acres planned provided the basis for the average cost per acre. Technical assistance costs are shown in Table G-82.

Cropland Treatment. Land treatment for cropland consists of the establishment of temporary practices, and installation of permanent type practices to control erosion, remove excess water, and treat unfavorable soil conditions.

Erosion control practices include contour farming, grassed waterways, diversions, stripcropping and cover cropping. There are 9,767,000 acres of cropland in the NAR that have erosion as the dominant problem. Approximately 3,557,000 acres have been adequately treated or are not feasible to treat.

Excess water problems require treatment measures to improve drainage and increase productivity. Open drains, diversions terraces, and waterways are used to remove excess surface water. Tile drainage is used to correct poor internal drainage conditions in some soils. There are 3,561,000 acres of cropland with excess

TABLE G -82

LAND TREATMENT - REGIONAL
NATIONAL EFFICIENCY OBJECTIVE
NORTH ATLANTIC REGION

Land Use By Dominant Problems	Present: Total Land	Present: Requiring Treatment	Suggested Treatment, Time Frame Years: 1980	2000	2020	Total	Treatment Cost for 1980 1/: Instal-lation	Tech. Asst.	One Time
	Million Acres						Dollars Per Acre (Rounded)		$ Million
Cropland									
Erosion	9.7	6.2	2.5	1.8	.3	4.6	31	11	104
Excess Water	3.6	1.7	.4	.8	.2	1.4	56	11	27
Unfavorable Soil Conditions	1.8	1.0	.3	.2	.1	.6	11	12	7
Few Limitations	1.0	-							
Subtotal	16.1	8.9	3.2	2.8	.6	6.6			138
Pasture									
Erosion	3.5	2.1							
Excess Water	1.5	.9	.4	.2	.1	.7	59	11	28
Unfavorable Soil Conditions	1.6	1.0	.4	.3	-	.7	162	13	70
Few Limitations	.1	-							
Subtotal	6.7	4.0	.8	.5	.1	1.4			98
Forest									
Management 2/		53.0	7.7	12.5	12.4	32.6	16	8	183
Protection 2/		(52.9) 3/	(6.2)	(11.2)	(11.2)	(28.6)	1	2	23
Erosion	16.3	(.2)	(<.1)	(.1)	(.1)	(.2)	57	10	2 4/
Excess Water	9.6	(6.1)	-	(.2)	(.5)	(.7)			
Unfavorable Soil Condtions	43.3	-							
Few Limitations	.5	-							
Subtotal	69.7	53.0	7.7	12.4	12.4	32.6			206
Other									
Erosion	2.6	1.0							
Excess Water	2.5	.9	.5	.6	.5	1.6	139	13	76
Unfavorable Soil Conditions	1.3	.5	.3	.4	.4	1.1	46	14	18
Few Limitations	.5	-							
Subtotal	6.9	2.4	.8	1.0	.9	2.7			94
Urban									
Subtotal	6.3	-	.8	2.2	3.1	6.1	126	12	110
TOTAL	105.7	68.3	13.3	19.0	17.1	49.4			646

1/ Price base 1970.
2/ Protection and management requirements are needed for all dominant problems.
3/ Figures in parentheses are not included in totals.
4/ These costs are totals of the subregional costs set forth in Tables 6-84 through 6-89. Installation and technical assistance costs vary with differences in the mix of measures needed in the various subregions; average costs are shown in this table.

water problems in the NAR. Approximately 1,842,000 acres have been adequately treated or are not feasible to treat.

Unfavorable soils require treatment for stabilization or improvement. Some treatment measures include crop residue management, mulching, subsoiling and minimum tillage. There are 1,747,000 acres of cropland in the NAR that have unfavorable soil conditions as a dominant problem. Approximately 1,013,000 acres have been adequately treated or are not feasible to treat.

There are 962,000 acres of cropland that have few limitations and do not need treatment. Approximately 6,412,000 acres of the 16,047,000 acres, representing 40 percent of the cropland, are adequately treated or not feasible to treat. Expected treatment of cropland acreages for 1980, 2000 and 2020 are shown on Table G-82.

Pasture Treatment. Land treatment for pasture is for problems relating to the establishment and maintenance of cover, renovation, reseeding, fertilizing and management. Erosion is the dominant problem on 3,511,000 acres of pasture. About 1,480,000 acres have been adequately treated or are not feasible to treat. Excess water is a dominant problem on 1,497,000 acres of pasture. About 573,000 acres have been adequately treated or are not feasible to treat. Unfavorable soil conditions are the dominant problem on 1,581,000 acres of pasture. About 557,000 acres have been adequately treated or are not feasible to treat.

There are 113,000 acres that have few limitations and do not need treatment. Approximately 2,610,000 acres of the 6,702,000 acres representing 39 percent of the pasture have been adequately treated or are not feasible to treat. Expected treatment of pasture acreages for 1980, 2000 and 2020 are shown in Table G-82.

Forest Treatment. Land treatment and costs are based on the needs for the orderly management, establishment and reinforcement of forest stands; stand improvement; protection from fire, insects, disease and overcutting; erosion control, and logging road and skid trail rehabilitation.

Acreage needing treatment, and suggested treatment for the NE objective are presented by time frames in Table G-82 (Regional Summary) and within each Subregional Summary. Suggested treatment was derived from projections of accomplishments of current programs at present levels plus a percentage of the presently identified needs which will remain unmet in 2020.

PROJECTED FOREST LAND TREATMENT AT PRESENT RATES, AND UNMET NEEDS

Dominant Problem	Area Requiring Treatment	Projected Treatment at Present Levels 1980	2000	2020	Total	Remaining Area Needing Treatment
		(million acres)				
Management	53.0	3.7	4.4	4.3	12.4	40.6
Protection	52.9	1.3	1.5	1.5	4.3	48.6
Erosion	.2	-	-	-	.1	.1
Excess water	5.3	-	-	-	-	5.3

For the NE objective, the percentages of these remaining needs which were added are 10 percent for 1980, 30 percent for 2000, and 50 percent for 2020. For the RD objective the corresponding percentages would be 20, 50, and 80, and for EQ, 30, 70, and 100. Two exceptions were made. For "excess water" under forest land, the suggested treatment for all three objectives is the same and is shown in Table G-82. All erosion control needs are to be met for all objectives by 2020. Costs shown include both technical assistance and installation.

The treatment needs on forest land are summarized in Table G-82 into four main categories: (1) management (2) protection (3) erosion and (4) excess water.

Management needs consist of three basic items: (1) management plans for the orderly development and operation of forested areas, (2) tree planting for the establishment of future forest stands, the control of erosion and enhancement of environmental quality and (3) stand improvement for the production of quality forest products and the improvement of forest soils.

Forest protection consists of the needs for protection of forest stands from fire, insects and disease, overgrazing by domestic animals and overcutting.

Erosion control needs consist of critical area stabilization, and sheet and gully erosion.

Excess water in the soil inhibits the maximum production potential of various tree species. Needs for excess water control on forest land are limited to those species which would respond to water control treatment (Appendix J - Land Drainage, prepared by U. S. Army Corps of Engineers).

<u>Accomplishments</u>. Approximately 16.8 million acres of national, state, and industrial forest land have plans for management. Another half million acres of nonindustrial privately owned forest

land, in almost 10,000 separate ownerships, are also covered by management plans of varying degrees of detail. Tree planting in the region averaged about 151,000 acres per year from 1957 to 1968, (USDA Forest Service, Tree Planters' Notes, Vol. 19, No. 5, 1968); at this rate the needs identified in 1963 will be met by 2000. Changes in land use will probably result in small amounts of additional planting on a continuing basis. Timber stand improvement averages about 62,000 acres per year, and control of grazing is effected on about 3,100 acres annually.

All forest land in the Region receives fire protection. Except in exceptionally severe years all states generally meet their established forest fire control objectives, though occasional areas of high fire occurrence exist. Control agencies are developing cooperative relationships with volunteer fire companies and are improving technology in detection and control.

Projected treatment at present levels of accomplishment, and the presently identified needs which will still remain unmet in 2020 are shown on page G-193.

Other Land Treatment. Major practices for the treatment of Other land relate to problems of providing wildlife habitat, critical area erosion control and recreation. Erosion is the dominant problem on 2,620,000 acres. About 1,608,000 acres have been adequately treated or are not feasible to treat. Excess water is the dominant problem on 2,476,000 acres of Other land. About 1,612,000 acres have been adequately treated or are not feasible to treat. Unfavorable soil conditions are the dominant problem on 1,327,000 acres of Other land. About 808,000 acres have been adequately treated or are not feasible to treat.

There are 477,000 acres that have few limitations and do not need treatment. Approximately 4,028,000 acres of the 6,900,000 acres representing 58 percent of the Other land have been adequately treated or are not feasible to treat. Expected treatment of Other acreages for 1980, 2000 and 2020 are shown in Table G-82.

Urban Land Treatment. Urban expansion will require treatment of lands undergoing Urban development from Other land uses. Urban land is treated with temporary practices designed to reduce erosion and sedimentation during the construction stage when soils have been denuded of vegetation and are subject to severe erosion. Temporary practices such as sediment traps, diversion terraces, seeding and mulching are used to reduce erosion and sedimentation. Expected treatment of Urban acreages for 1980, 2000 and 2020 are shown in Table G-82

Resource Problem Solutions

General Approaches to Solution of Forest Land Problems. Some further explanation is needed of the treatment of forest land suggested

Table G-82. The projected demand for forest products can be met if the suggested treatment for the EQ objective is implemented, accompanied by improved processing of forest products. This would include the use of residues, improved sawing and drying techniques, development of better manufacturing equipment, and the use of species not now considered merchantable. Preparation of management plans must be accelerated as the first step in securing better management of privately owned forest land. Tree planting provides for future forest and related resources, retards runoff, and reduces sedimentation. Timber stand improvement maximizes timber yields and quality and is expected to return cost of treatment within 15 to 20 years.

Enactment of the National Fire Disaster Act, sponsored by the American Forestry Association, would provide the means for meeting disaster situations. A key provision is for regional training and dispatching of men and equipment beyond the capabilities of individual states. Fire prevention programs must be strengthened, based on a research program that will develop improved techniques.

Effective forest pest control could increase the available timber product supply by a minimum of 10 percent. Selective methods of control also benefit recreation, fish and wildlife, and environmental quality.

Grazing control is effected through exclusion of domestic animals from forest land by fencing. Because grazing of forest land cannot economically compete with grazing on improved pastures, normal attrition is effecting a reduction in area grazed by about 15 percent annually. For this reason, the present rate of program accomplishment is considered satisfactory.

Treatment measures for erosion consist of proper location, grading, and installation of water dispersion measures on forest roads and trails, and the planting of trees, grass and shrubs on abandoned logging roads, skid trails, and areas otherwise disturbed.

Flooding. In upstream areas there are a total of 109 authorized PL 566, PL 534 and Pilot watershed projects which include 492 dams with about 527,000 acre feet of flood storage, and 1,474 miles of channel improvement. In addition to land adequately treated, treatment is planned on 2.4 million acres. These projects will reduce present average annual damage by $8.9 million, leaving a damage of $400 million.

Additional flood prevention benefits can accrue from land treatment and management. Proper land treatment and management reduces peak flows by increasing the infiltration capacity of the soil and slowing the overland flow of water. Land treatment and management can account for 2 to 5 percent reduction in flood damages. In the NAR if all the land were treated and managed properly, damage reduction could amount to about $8.0 million in 2020. Further

damage reduction could be achieved by flood plain management. At the present time it is difficult to appraise nonstructural flood plain management measures due to engineering, economic and social problems in evaluation.

Erosion and Sedimentation. Relatively simple conservation measures can be instituted which will reduce the quantities of sediment that are derived from construction sites. The conservation procedures should include saving as much natural vegetation as possible, disturbing only the areas undergoing immediate construction, limiting the steepness of slope for roads and streets, replacing plant cover by temporary or permanent seeding as rapidly as possible, insuring adequate design for drainage systems and installing temporary sediment traps where necessary.

The most significant factor for the control of erosion and sedimentation is vegetal cover. Vegetation intercepts and disperses the energy of falling rain, decreases the velocity of runoff from the ground surface and improves the water infiltration properties of the soil. Land denuded of vegetation may erode at rates more than 100 times that of good pasture or forest.

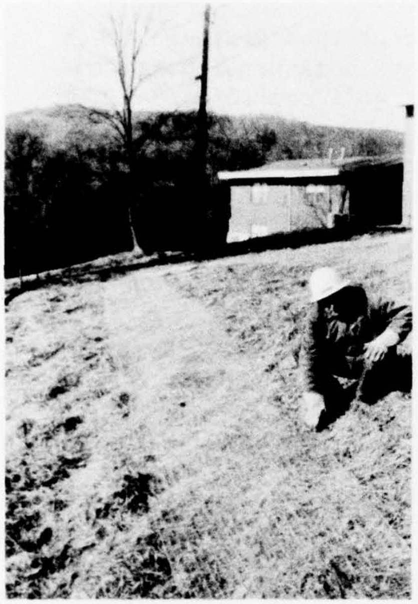
Land treatment plays an important role in the reduction of erosion and sedimentation. With an accelerated land treatment program erosion and sedimentation problems can be greatly reduced. See Appendix Q, Erosion and Sedimentation, for further information.

Sediment. Soil conserving cultivation practices, efficient use of irrigation, timber harvest adapted to the soil, careful road location and construction, will all reduce erosion and sedimentation hazards.

Animal wastes. Practices that are helpful in reducing stream pollution potential from feedlots include detention ponds; diverting natural runoff around the feedlot; maintaining dry litter in feedlots; establishing deep manure stabilization ponds for anaerobic decomposition; providing aerobic sewage lagoons or oxidation ditches; and establishing vegetated buffer strips adjacent to feedlots and streams to intercept runoff and act as natural filter beds.

Processing Industrial Wastes. Many of the practices found helpful in reducing stream pollution potential from feedlots can be modified to be helpful in reducing pollution potential from processing industries. These modifications are necessary because of (1) plant operations resulting in large waste concentrations, (2) high seasonal loadings, and (3) different types of loadings.

Plant Nutrients. The best way to control the nutrients in streams, ponds and reservoirs that arise from agricultural sources is to use soil conservation practices, and structures that reduce runoff and sediment delivery from fields and farmsteads.

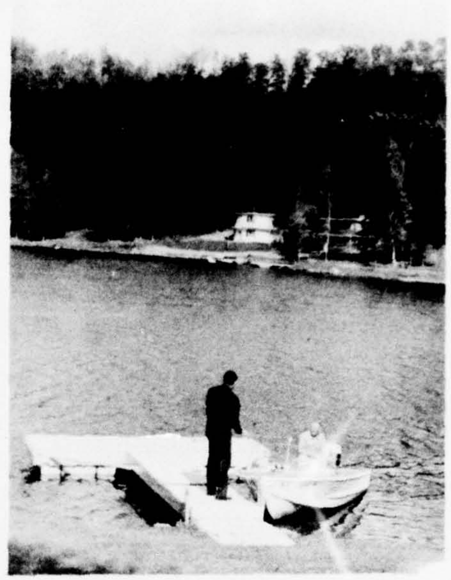


Critical area seeding with straw mulch and netting to prevent soil erosion.

Well designed storm drain for protection from erosion.

Well planned subdivision making optimum use of existing topography and trees.

Well vegetated drainage ditch prevents soil erosion and improves golf course landscape.

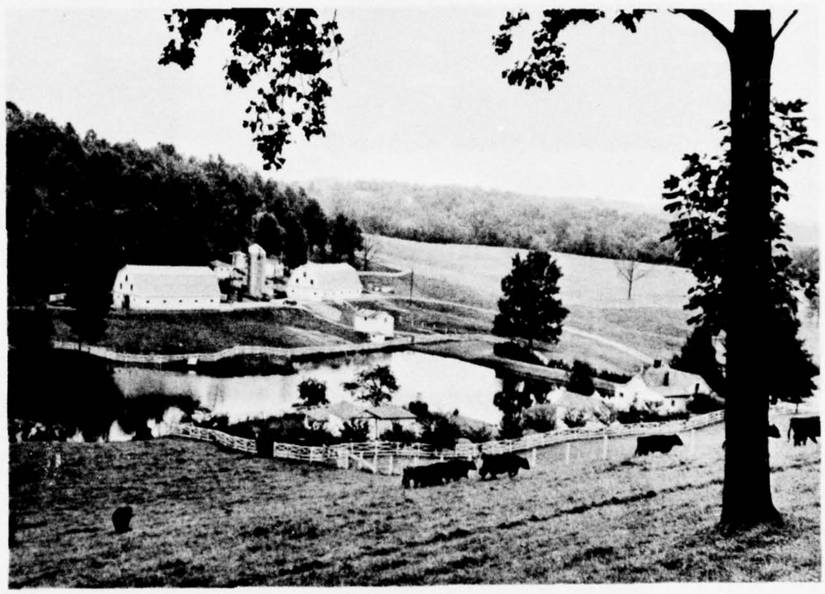


Second homes furnish escape from working pressures.

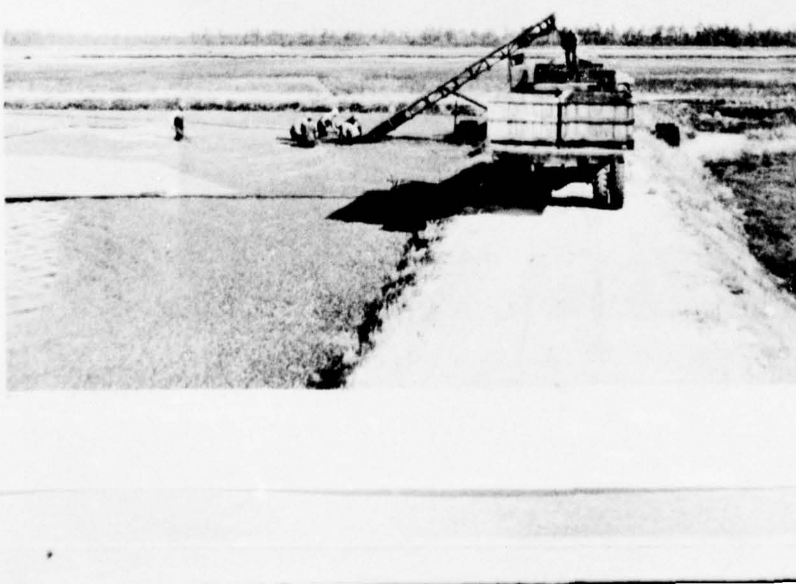
Planned Unit Development provides recreation for residents.

Multipurpose reservoir serves as recreation area for Boy Scout Camp.

Contour planting and stripcropping prohibits soil erosion and water runoff.

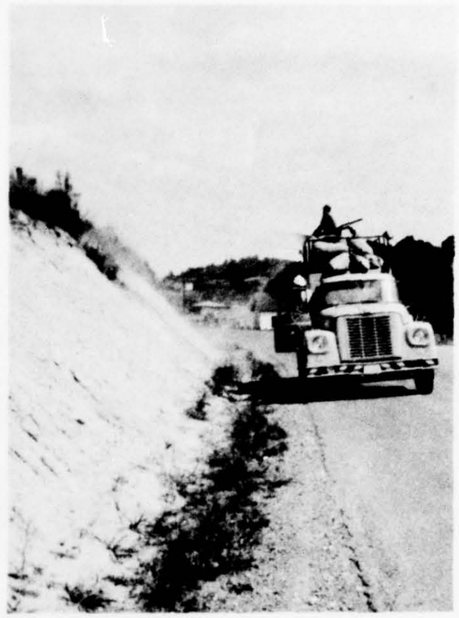


Good pastures and good cattle with adequate water are foundation for prosperous farming.



Cranberry harvest by the water picking method. The floating berries are loaded on trucks with an elevator.

Netting holds mulch and prevents erosion during highway construction.



Seed, fertilizer and wood fiber mulch applied simultaneously to eroding road banks.

Highway interchanges can be designed to retain trees and shrubs for a pleasing landscape.

Properly designed and constructed septic systems and wells, protection of surface supplies from contaminants, and proper disposal of animal wastes would keep self-supplied water systems free of nitrates. Public water distribution systems and public sewage systems are needed to serve more densely populated rural areas.

Chemical Exotics

Detergents that do not cause algal growth and will decompose in sewage treatment processes need to be developed for use. Percentages of phosphates in major detergents range from over 40 to under 2. Substitutes for detergent phosphates are available. Product standards need to be established.

Pesticide chemicals must be approved by the USDA, Department of Health, Education and Welfare (HEW), and the Department of the Interior (USDI), before being offered for sale, The label, as well as the chemical, must be approved. Most states also have pesticide registration regulation.

Use of substitutes that are more selective and less toxic, hazardous and persistent is encouraged. For example, because of its potential ecological effect the use of DDT has been restricted and substitute materials are used.

Infectious Agents. Control of an infectious agent depends on a knowledge of the ways the agent is transmitted and the situation it must have to attack and grow on or in a plant or animal. Combined efforts from all levels of government are needed to provide disease control and maintain a high level of vigilance to prevent the disastrous outbreaks of communicable diseases.

Sanitary Landfill. In the selection of potential sanitary landfill sites, many factors must be considered. The source and nature of the waste and the distance from the source to the landfill site is important. Transportation routes to the landfill site require careful planning and the roads must be designed to handle heavy trucks.

The geologic and topographic conditions must be studied. Bedrock close to the surface, fissures, faults and limestone are some geologic conditions which may lead to problems. Topographically steep rugged slopes and low swampy areas have undesirable characteristics. Sanitary landfill in these areas can lead to potential pollution of surface and ground water supplies. Flooding of low swampy areas presents erosion problems and periods when operations would be stopped owing to high water or wetness of the soil. Table G-83.

Selections of desirable sites and proper operation of sanitary landfills is of major importance to good land use. Completed sanitary landfills can be used for recreational purposes such as parks, playgrounds and golf courses. Construction of buildings directly

TABLE G-83

SOIL CHARACTERISTICS AND GROUPINGS OF
LAND USE CAPABILITY CLASSES USED IN
EVALUATING POTENTIAL SANITARY LANDFILL SITES
NORTH ATLANTIC REGION

L.U.C. CLASSES (USDA-SCS)	I IIe IIs	IIIe IIIs IVe	All Other Classes
Soil Characteristics or Properties	SUITABILITY LIMITATIONS		
	SLIGHT	MODERATE	SEVERE
Flooding Hazard	Never	Less than once in 35 years	More than once in 35 years
Depth to highest seasonal water table	More than 12 feet	6-12 feet	Less than 6 feet
Risk of free flow to ground water	Not underlain by cavernous limestone or coarse sand and gravel or extensively fractured shales	More than 6 feet of fine soil over limestone or coarse sand and gravel	Less than 6 feet of fine soil over limestone or coarse sand and gravel
Depth to Bedrock	More than 6 feet	4-6 feet	Less than 4 feet
Permeability at bottom of excavation	.63-2.0 In/hr.	2.0-10.0 In/hr.	More than 10.0 In/hr.
Soil Texture	Coarse and medium	Moderately fine	Fine and very fine muck, peat
Slope	0-8 percent	8-15 percent	over 15 percent
Rock outcrops	None	None	Numerous
Stony content	None	None	Very stony

on sanitary landfill has generally been avoided in the past but, with special engineering design, buildings can be built on sanitary landfill sites.

Strip Mining. Treatment includes reclamation for spoil stabilization, erosion control and improvement of water quality. Restoration in most cases can be accomplished by vegetating areas with trees, shrubs, grasses, and legumes. In most cases, grading and backfilling is necessary before cover can be established. Some sites may offer opportunities to develop water impoundments.

Surface mined area reclamation, if properly planned treated and developed, has great potential for wildlife habitat, farm and forest recreation, ponds and reservoirs, and residential, institutional and industrial development.

Watershed Yields. The use of land, type of crops grown, and the management of open land and forest can have a measurable effect on the volume and distribution of runoff. As a result of these improved land conditions, additional water enters the soil through infiltration to recharge the ground water, part of which will appear later as springs, increasing and prolonging the low flows.

Improved cover conditions will have a larger effect on low flows than annual yields. The Delaware River Basin Report indicates that low flows will increase from present to 2060 in a range of 2.0 to 6.0 percent while annual yields will increase in a range of 0.5 to 1.5 percent.

Five year old hybrid poplars stabilize strip mined sites.

LEGAL DEVICES FOR GUIDING URBAN GROWTH

Guiding the Process of Development Today

The use of techniques for guiding development varies in accordance with the objectives being sought.

At a regional scale these techniques might effectively prohibit or restrict new development in areas that should be preserved in their natural state (e.g., the forested area of northern Maine and the New Jersey Pine Barrens). Other areas should possibly be reserved for agricultural use. Still others, such as the southern New England coastline, should be protected for recreational activities.

The techniques for guiding development should also carry out such varied policies as extending open space, preventing development in flood plains and preserving areas of historic and sentimental value.

So far the techniques used have not done a satisfactory job of achieving these, or even more modest goals. An examination of today's development process suggests that many developers, builders, investors, consumers, legislators, have some opportunity to raise the quality of urban development - and that most of them are not using their opportunity. Why? Partly because development decisions tend to be so diffused that such opportunities scarcely exist at all. At least as often, though, the problem seems to be that the quality of urban development is simply not considered as important as some other public or private objective.

This situation is most serious and unfortunate in governmental programs to tax, to spend, and to build. Government at all levels does, in fact, influence urban growth patterns in many ways. Highway construction, mortgage insurance, control over the money supply, taxation of capital gains on land, real estate tax assessment practices and literally thousands of other public actions affect urban growth patterns directly or indirectly.

The problem is that these public actions are rarely calculated to achieve overall urban development objectives. To some extent, this results from the complexity of the relationships involved. It is often hard to demonstrate the whole impact of a proposed action - and even harder to demonstrate it convincingly enough to persuade the men who decide policy. Another part of the problem is essentially bureaucratic: nobody likes to be coordinated. If a functional agency (such as a highway department) takes a narrowly functional view of its responsibility, it may be expected to resist any modification of its program in favor of broader interests.

Still another part of the problem is to determine what the broader interest really is. It is often difficult, for example, to demonstrate that some particular urban pattern is so desirable that it is worth a lot of trouble to bring about. In any event, and

for whatever reason, public actions, which could be used as powerful tools used by governments to guide development, primary consideration must be given to zoning and subdivision regulations. Of course, these are far from the only intentional tools available. Tax incentives (to preserve agricultural lands, for example) can be considered such a tool, at least potentially. And there are programs to acquire land (including programs to acquire easements or other partial interests), for open space or other uses. Nonetheless, measured by public awareness or by the sheer quantity of statutes or ordinances or administrative activity, it seems indisputable that local land use regulations continue to be the principal form of conscious control over development.

There is widespread dissatisfaction with the effects of these controls. Urban development patterns are increasingly regarded as inefficient, unenjoyable, exclusionary. Coherent regional planning policies seldom guide the location or timing or nature of new developments. If local land use regulations have such a major place in the nation's efforts to create a good urban environment, then they must share the blame for our failure to create it.

Many of the troubles with local regulations can be explained by: (1) the nature of the local governments that adopt them; (2) the nature of the development process they are supposed to regulate; and (3) some inherent problems of the regulatory process.

Localism

With rare exceptions, regulations are adopted and administered by local governments. As a result, there is great variety from place to place in what the regulations try to do and in how well they do it. They reflect attitudes encountered in different localities (or toward different parts of the same locality), and their effectiveness depends on the changing abilities of local administrators. Nonetheless, it is possible to suggest some common characteristics and complaints. As with other public actions mentioned previously, the relatively low priority given to creation of desirable urban growth patterns is apparent almost everywhere.

Absence of regional concern. It is hardly surprising that local regulations are more responsive to local than to regional concerns. Local legislators and their constituents often exhibit little concern about the solution of regional problems. This is particularly true when regional and local interests conflict. In general, local regulations normally give low priority to carrying out regional plans and policies, even when such plans and policies have been enunciated through regional agencies.

Hesitancy to control private property. It is generally agreed that free use of property should be limited only for a good reason, and in many communities there still are not thought to be many good reasons. Freedom to exploit the land remains an important value

in many communities, especially in rural and exurban ones. Any public desire for development quality often comes off second best. Some communities are thus willing to restrict land use in only a few circumstances - to prohibit junk yards or other disliked uses, perhaps, or to protect the homogeneity of single-family residential neighborhoods. These same communities may be unwilling to intervene in other situations - arresting the decline of an older neighborhood, for example, or stopping the pattern of speculation and blight along highways.

Dominance of fiscal problems. Keeping tax bills down is considered a good reason for restricting land use in most communities. Since financial problems usually weigh heavily on municipal officials, it is not surprising that land-use controls are often used to reduce them. Some of the most far-reaching regulatory measures, usually contained in subdivision regulations, shift to developers (and ultimately to home buyers) many of the facilities' costs that used to be a burden on taxpayers. The game of "fiscal zoning" calls for public officials to welcome net taxpayers (e.g., many industries), while prohibiting net tax burdens such as some homes. Large-lot zoning, requiring 1- or 2- or even 5-acre minimum lot sizes, is perhaps the most widely known technique used for this purpose.

Exclusionary social objectives. To an extent that is difficult to determine, exclusionary zoning regulations in some communities respond to social as well as to fiscal objectives. In such instances, the objective, though seldom formally expressed, seems to be to keep out people who "wouldn't fit" with those already there.

Administrative difficulties. Finally, even when objectives present no problem, many local governments find it difficult to carry out such complicated tasks as planning and land-use-control administration. Thousands of local governments do not have even one full-time professional staff member for these complex technical functions.

The Nature of the Development Process

It is a truism that regulators respond to the industry they regulate. Land-use regulators are no exception. As the development process changes, the guidance process gradually responds. An important example of such response is the recent proliferation of "*planned unit development*" regulations. At its outset, zoning had to regulate one-lot development. At that time, each builder put up one (or perhaps a few) houses at a time, each on a separate lot, so the lot was a natural regulatory unit. In recent years, however, builders have begun to operate at a much larger scale. An increasing number want to build apartments or "cluster" projects that do not conform to one-lot zoning controls. In addition, some developers cut across functional lines, perhaps building shopping centers as well as homes. The developers began to press for modification of regulations to fit their operating needs. Often with the support

of planners who had been unable to sell their regulatory concept until developers were ready to use it, local governments responded by adopting planned unit regulations.

It seems worthwhile, then, to note some of the accepted features of the development process today:

Functional initiative. To a considerable, though perhaps decreasing extent, development initiative is distributed along functional lines rather than geographic ones. The builder who "puts the deal together" often builds only homes or gas stations or highways or office buildings. Rarely, in the United States, does the man with initiative have responsibility for a full-range of urban functions within a geographical area.

There are several important consequences of this situation for guiding development:

First, it means that geographical relationships among functions often have to be imposed on the builder from without. Especially when he operates at a very small scale (one highway business establishment, for example), he has virtually no power to do that coordinating for himself, and he often has little concern about it. Doing a good job of coordination is not a consideration he uses in judging the quality of his work.

Second, it means that there is often a real estate transaction shortly before development - not always, of course. Some developers are able to stockpile land in advance and some development is undertaken by people who start with a tract they want to develop. In many instances, though, the functional developer obtains his land shortly before he plans to build. This means, normally, that he pays a full current price for the site. If the land is zoned, he will have to pay a price for the permitted use, and perhaps some more because of monopoly factors that favor the seller. This means that the previous owner, rather than the developer, makes the profit on the land. If the developer wants any land profit, he must often seek rezoning. Experience shows that changes in zoning, rather than a preset zoning pattern, determine ultimate development patterns. Moreover, the absence of land profit may interfere with any thoughts of providing desirable urban amenities. At least one developer of new communities frankly acknowledges that he can provide desirable amenities only when he is fortuitously able to buy land from owners who do not recognize its development value.

Relatively short-term profit. Just as land is often sold shortly before development, so is it often sold shortly afterwards. Here, too many individual variations exist. It is nonetheless significant that so much of current development is intended to yield a profit rapidly. Most developers are not actively concerned about the long-term future.

This situation has two serious consequences for the process of guiding development:

First, it means that the developer need only consider the open space recreation and similar demands of today's consumers, even if he suspects that those demands will be much higher in the future. As a result, planning for amenities that might ideally be handled directly between the builder and his ultimate consumers - over a period of years - must instead be handled by the government. Many fussy regulations result.

Second, it means that the developer is more concerned with construction cost than with maintenance cost, which will ultimately fall on buyers or on the local government. Again, many rules result as the local government tries (often excessively, it seems) to protect itself against possible future maintenance costs if pavements crack or sewer pipes break. Many arrangements for common open space and recreation facilities run into regulatory snags because the developer will not be there to maintain them, and the municipality is afraid it will be left holding the bag.

Some Inherent Difficulties of Regulations

Finally, the regulatory process may have some built-in difficulties. The key to many, though not all, of these difficulties is the impact of regulations on land values. This impact creates many of the legal, political, and administrative difficulties that determine the nature of regulations and limit their usefulness.

Any planning process must treat different sites differently, to take account of both natural and man-made conditions. In many situations, planning decisions reduce property value, although in others value may be increased (e.g., six sites have some speculative value for a shopping center until one is designated for development). Even when legal concepts of fairness are satisfied, political and administrative circumstances often limit the effectiveness of land-use regulations where major value differences are caused.

The problem is especially serious when planning policies indicate that land should not be developed at all. Available figures suggest that, even in the densely populated NAR, a sizeable part of the land will remain undeveloped as late as 2020. So far, public policy makers have not fashioned a satisfactory form of public intervention to designate which parts should remain open. It is noteworthy that present practice seems to call for the government to buy all the unprofitable sites (open space, for example) and to leave all the profitable ones in private hands. Thus, if a plan indicated that a 20-square-mile site should hold 125,000 persons, but that 5 square miles should remain as open space, the public would supposedly buy the 5 square miles and permit all 125,000 persons on the remainder. The taxpayers would absorb the full cost of the no-profit open spaces, but they would receive none of the profit on the developable area.

Likely Future Directions

No significant change in the process of guiding development will occur until decision makers become so discontented that they decide to act. It is clear enough that many people are dissatisfied with the results of today's guidance process. Consider the Regional Plan Association's (4) description of the exurban frontier. The region's future shape, the Association report says, "is being rather inadequately determined by opportunistic highway location, precipitous land speculation, lagging public services and sky-rocketing costs of providing them". Potentially compact facilities are "scattering in a random fashion over the landscape", particularly along highway frontages. Public as well as private agencies take part in this scatteration process. "The lure of cheap, large, undeveloped tracts, as opposed to the difficulties of land assembly and relocation in more densely built-up areas, is seducing public agencies into a similar pattern of random, scattered locations for their own facilities, such as universities and administrative buildings."

There are increasing demands that something be done about these and other urban growth problems. For example, the Advisory Commission on Intergovernmental Relations (19) has called for a national urbanization policy that would "provide the framework for harmonizing .... separate (federal) programs so that they support consistent objectives of population location instead of running at cross-purposes". Such a policy, the ACIR report continues, must be concerned "not only with the location or urbanization but also with its character and quality".

This proposal, and several others made more recently, suggest growing concern for urban quality objectives. Of course, existing federal legislation, by providing for planning agency review of certain federally-aided projects, already seeks to increase the likelihood that these projects will be in accordance with a metropolitan or regional planning process.

There is a growing criticism aimed specifically at local land-use controls as well. The most widely discussed criticism today relates to the exclusion of low- and moderate-income housing from many suburban and exurban areas. Another, earlier criticism is also being stated more and more forcefully. This second criticism, which could be called environmental, notes the failure of the system to protect the environment, prevent market excesses, and achieve even some elementary aspects of a good city. Regulating governments have been remiss in curbing exclusionary policies and have also been ineffectual in the environmental area.

Several recent studies and reports offer some clues to the probable future pattern of development. These include the reports of the Douglas (20) and Kaiser Commissions (21); the report of the Advisory Commission on Intergovernmental Relations, "Urban and Rural America: Policies for Future Growth" (19); the American Law

Institute's "Model Land Development Code" (22); the American Society of Planning Officials' Report on "New Directions for Connecticut Planning Legislation"(23); and the particularly stimulating report of Canada's Federal Task Force on Housing and Urban Development (24). Some of the main points of the reports are synthesized in Daivd G. Heeter's "Toward a More Effective Land-Use Guidance System", in the Winter 1970 issue of Land Use Controls Quarterly (25). Indeed, the very existence of these studies may suggest the growing realization that changes are needed.

Local Regulations

There is every likelihood that local land-use regulations will remain a fixture of the process of guiding development. Regulations will continue to be popular, in part, because they are the best way to do some jobs, such as setting minimum standards. For some other tasks, for which they are less suited, they will remain popular because they are often cheaper (in money, administrative skills, political objections) than alternative guidance techniques. Of course, if genuine public concern with development quality should grow significantly, willingness to pay the costs of superior alternative techniques (e.g., land purchase) should grow as well.

For both traditional and practical reasons, local governments will continue to bear major regulatory responsibility. Higher levels of government (particularly state and regional agencies) will increasingly review or limit local actions, but there is little prospect that higher level control will replace local regulations. Regulations are extremely popular among millions of their local beneficiaries and are accordingly among the most cherished powers of local government. Many of the concerns of these regulations are extremely localized, so it often makes sense that local persons should make the decisions without the interference of government at higher levels.

Improved regulatory techniques can enable regulations to achieve some desirable objectives that they have not achieved in the past. The importance of planned unit development provisions has already been suggested. Although important in a number of ways, their critical elements are: (a) extensive reliance on design review (rather than fixed numerical standards) to achieve public objectives; and (b) their recognition of the "cluster" principle which permits development to be spread unevenly over a tract.

"Holding zones", which temporarily prohibit development on land that will later be available for development would permit the guidance process to govern the timing as well as the location of development.

The various "bonus" provisions now common in center-city zoning regulations may provide an increasingly effective way to create incentives for quality building.

"Density transfer", which applies the cluster principle among land areas in separate ownership, could be a major breakthrough if it should prove lawful and workable. This amounts to a planned unit development provision applied to land that is not in single ownership.

Widespread improvement of the local regulatory process can only be achieved, it appears, by action above the local level, by state governments and by the federal government.

a. Removing incentive for local abuses. Measures to improve the financial condition of suburban governments, or to reduce the local tax burdens imposed by new development, would presumably lessen the economic incentive for exclusion of low- and moderate-income housing. Many such measures are under continuing discussion. Most such measures, however, are extremely expensive (e.g., state or federal assumption of more school and welfare costs) or require fundamental changes in established practices (e.g., reduction of local reliance on real property taxes). Accordingly, there is no prospect that they would be adopted solely for the purpose of removing the incentive to exclude.

b. Upsetting or avoiding improper local action. Aimed especially at exclusion of housing, a number of measures would bar improper actions by statute, or upset them in the courts or in administrative tribunals. For example:

A Massachusetts statute provides for streamlined appeals, to a state level agency, in a number of situations where local regulations exclude federally-aided housing.

The Kaiser Commission proposed that the federal government act to override local codes in certain cases where those codes effectively excluded federally-aided housing.

The Douglas Commission proposed federal action to facilitate court challenges of exclusionary zoning actions.

The Administration has recently proposed legislation that would prohibit certain exclusionary practices.

Several studies have recommended administrative review, by county or regional or state agencies, of local land-use decisions in individual cases.

New York State has established an Urban Development Corporation with statutory power to disregard local development regulations.

c. Encouraging or requiring localities to do a better job.

A number of other measures are meant to cause more effective use of local powers.

Some measures would require regulating governments to adopt specified types of plans or to undertake other nonregulatory measures to guide development (e.g., to adopt a capital improvements program). These measures can be applied to all regulating governments, or they can instead entitle the complying government to use a wider variety of regulatory tools.

There are many proposals for technical and financial assistance.

Statutory changes, too, can require the inclusion of housing elements in local plans and can establish a statutory policy that sites be reasonably available for housing of all income levels.

d. Even improved local regulations need to be supplemented and guided by state and regional regulatory action. No amount of outside action is likely to cause all communities to take even the most essential actions. Particularly difficult is protection of regional or statewide interests that are not perceived locally or that actually conflict with local interests. Statutes in some states already provide for direct state control of certain critical sites (wetlands, for example, or river banks, or highway edges). Sometimes these measures apply only in the absence of local control.

Hawaii's state zoning system divides the state into four districts (urban, agricultural, conservation, and rural). Local regulations must operate within these state-established restrictions.

Beyond Regulations

As regulatory agencies have long been aware, and as the recent studies recognize, there are effective limitations on what even the best regulatory system can achieve. Some of the limitations are legal. Others, probably more fundamental, are political and administrative. In any event, as such objectives as open space preservation and development timing become more highly valued, the need for supplementary public action becomes clear. For some objectives, outright land acquisition is apparently necessary.

Compensatory payments could validate regulations that would otherwise be unlawful. Where regulations amount to a taking of property or are otherwise unconstitutional, one of the recent studies (that of the American Law Institute) proposes to validate them by offering partial compensation to the landowner. The recent New York Law Revision Study has recommended a similar approach. The Douglas Commission would permit an owner to bring an inverse condemnation action if he believed the regulation unconstitutional to obtain compensation, however, he would have to give up his entire interest in the land.

Public land acquisition has been recommended frequently enough to make its adoption more likely in a broadening number of situations.

Of the recent American studies, the Douglas Commission recommended the most far-reaching powers to acquire land. Its recommendation would make land acquisition an available local or state tool to guide development or to reserve "to the public gains in land values resulting from the action of government in promoting and servicing development". The Commission further recommended that federal financial assistance, in the form of a federal revolving fund, be established to facilitate property acquisitions.

Large open space acquisitions. It is often suggested that open spaces, like transportation arteries, be used deliberately to determine urban form. Acquisition of open spaces for parks, forest preserves, watersheds, is a well-established form of public action.

The large and growing literature on open space protection most often suggests outright public land purchase. Taxpayers can sometimes be persuaded to approve the expenditure of substantial sums for this purpose. Some proposals call for acquisition of easements or other less-than-fee interests in certain types of open space. Tax abatement measures (e.g., for agricultural land) are also sometimes used.

Large-scale urban and new-community development assistance. A number of measures have been proposed, and some have been adopted, to stimulate large-scale urban and new-community development. At the very least, financial assistance is needed to assist with "investment costs resulting from the long period required for land assembly and improvement, and construction of utilities before revenue from the sale of sites or structures is sufficient to provide a net profit". Assistance in land assembly including the power of eminent domain, is also widely discussed.

Finally, it has been proposed that the states charter corporations to assemble land or actually develop the communities. New York State's Urban Development Corporation and Puerto Rico's Land Administration are both significant steps in this direction.

Recapture of land profits. Finally, there are proposals to recapture, for the public, some or all of the increase in land profits - particularly that which results when land values change from rural to urban. As already noted, the Douglas Commission has recommended that land acquisition be authorized for this purpose. Special tax measures have also been proposed for the purpose. Puerto Rico already taxes land profits more heavily than other capital gains.

Additional Measures Needed

Although improved techniques can increase regulatory potential, the improvement could only be marginal. The development guidance problem is only partly one of inability; it is much more one of unwillingness to use available tools in a creative and effective way. In the long run, the necessary willingness seems likely to

come only from fundamental changes in the scale and financing of local government. It now appears that such changes would be more likely to alter the effect of land-use controls than any changes in techniques, for a larger local government, if adequately financed, is more likely to take the broader, longer-term view of planning that is necessary to make controls work. These same changes in scale and financing would likely increase local administrative capability as well, particularly by increasing reliance on professional planning staff.

A fundamental problem with regulations, though, remains their essentially negative nature. Regulations are well suited for setting genuinely minimum standards that ought not to change, but they have done an ineffective job of stimulating variety or encouraging creativity. At least they have so far.

If regulations cannot do the whole job, what can? At least how, in general, ought it to be done? The answer, surely, is by creating incentives so that the developer wants to create a good community and has the power to do it. This is not easily done. Finding a way, however, seems to be the best hope for overcoming the limitations of control.

Creation of incentives will require answers to questions such as these:

Is there any greater likelihood of satisfactory development if the developer is a public agency rather than a private one? Or does maximum opportunity lie in deliberately encouraging changes in the methods of private operatives?

Who really would be considered the "consumer" of the developer's products? In practice, today's residential developer must deal with the municipality as a consumer. The municipality will own the new streets he builds as well as a number of other facilities that add up to a significant fraction of residential building costs. Would it be better if responsibility for these facilities remained an obligation of the developer, or of an association of home owners, of a corporation that owned the profit-making parts of the development (such as a shopping center)?

If large-scale developers have greater opportunity to design good development, how is such large-scale to be encouraged? What sorts of actions would permit them to grow larger? Are the current "new communities" aids sufficient? Is land banking essential for this purpose? Would devices to encourage today's land speculators to assemble larger tracts be sufficient?

If the developer's incentive grows when his involvement lasts over a substantial time period, how can public policy encourage that longer-term involvement? Would changes in the federal income tax treatment of land profits enable developers - rather than their

predecessors in title - to obtain some of those profits? Would changes in the depreciation allowances effectively encourage longer-term participation after development? Would this have the desired incentive effects? Or would it just increase the developer's costs of doing business? How can continuing developer involvement be reconciled with widespread public demand for home ownership? If new homes are owned, are there enough nonresidential portions left within a development to make continued developer participation worthwhile? Or should maintenance obligations be separated from ownership rights?

While some of these questions are unanswerable at this time, it does seem possible to make a few suggestions about future opportunities:

First, the greatest opportunities to shape the process lie at the federal level and, to a lesser extent, at the state level - not at the local level. This is true because the federal government has more money to spend, because its income tax laws set up the business framework within which every developer operates, and because it is generally more perceptive and concerned about the problems.

Second, it is far from clear that - out of a range of federal priorities - development quality will receive as high priority as many would like. Even if one considers only "urban problems", there appears to remain a serious conflict between quality and quantity. All governments have had to wrestle over a period of decades with a clash between (1) obtaining for everyone an environment that is at least decent; and (2) encouraging real quality for those who can afford it. There is widespread feeling that localities are not resolving the conflict equitably when they adopt exclusionary zoning laws, and it appears likely that the federal or state governments (or both) will in time take action to limit or end this exclusion. Unfortunately, the techniques most likely to be feasible (overriding local zoning) seem likely to be negative - to concentrate on curbing harmful local action (much as towns curb over-zealous developers)- and to weaken still further the weak tools now used to obtain urban quality. It is noteworthy that many of those most concerned about quality will, if a choice must be made, rank minimum-decent-standard-for-everybody as the higher priority.

Third, a sheer increase in housing supply seems more likely than any other method to give the consumer some choice that means something. The federal government might conclude that the long-range importance of this outweighs the sensitive development that environmentalists want.

Fourth, if the federal government can find a way to obtain supply by increasing large-scale development (perhaps in conjunction with encouragement of new building technology), the new

developers might take care of many of the land assembly problems that now seem so nearly insurmountable. Extending or broadening eminent domain powers is easier when major producers want it.

Fifth, approaches based on spending (federal or state, direct or indirect through taxation) may well prove more feasible than approaches that concentrate on land ownership. Public land ownership, even though it appears to have worked admirably in other countries, seems likely to be particularly difficult in a country where land speculation is such an important part of our traditions; and it requires huge outlays of public money, which so far have been running into legislative difficulties. As with so many other changes during recent decades, it may well prove easier to work at the less visible level of federal spending to assist production - and let these changes generate demands for any necessary changes in land-holding patterns.

Sixth, an effort to encourage large-scale developers may be assisted by measures that would cause all developers (small, as well as large) to bear their full share of public costs arising out of development. At present, the taxpayers still finance some of the large-scale facilities. As a result, a builder of new communities may end up providing at his own expense something that smaller developers get from the taxpayers (e.g., major open spaces). It is important to know how much of a public subsidy is involved in such cases - either as a basis for shifting costs to smaller developers, or, more likely, as an economic justification for giving larger subsidies to large developers than to small ones.

Seventh, the present drive for new communities assistance may well be more fruitful than any other approach now on the horizon. Although there is little indication that new communities are inherently the best way to provide minimum decent environments for the poor (when compared, say, to a rent supplement or home ownership assistance that the poor person might use wherever he chose), the supporters of both quality and quantity seem to have forged an alliance so that each gets something from the new community. Even if some new communities do not have the high amenity standards associated with famous pioneer developments (as seems likely), the program offers the greatest present opportunity to have the owner of a sizeable geographical area be responsible for its overall planning. If the number of such large developments should ever be sufficient to increase housing supply substantially, we would have made a major step toward creating communities that satisfy consumer choices.

LEGAL DEVICES FOR GUIDING LAND DEVELOPMENT

Formal legal devices available for the control of land use fall into three general categories: (1) ownership control, (2) nonownership controls, and (3) incentive controls.

The ownership controls consist of devices such as fee simple purchase, purchase lease agreement, easement purchases, deed restrictions, and land owner agreements.

Nonownership types of controls include zoning, building codes, control regulation, and compensatory regulations.

Incentive controls include tax incentives, subsidies, grants for pollution control, and real estate tax abatement. For a detailed discussion of legal devices see Appendix N, pages 120 to 122.

Essential to planning on a regional scale is the legal authority to enter into intergovernmental agreements. Authority should be available to enter into informal and formal agreements with agencies and to designate a responsible agency for review and approval of all plans affecting land and water use.

The vesting of legal authority to issue bonds subject to referendum by the voters is necessary to provide funding for land use planning and development. General bonds, special assessment and revenue bonds are devices needed to finance development programs. Authority to obtain property control by gift, purchase, eminent domain and the authority to accept grants are necessary legal devices for effective land use planning and development.

INSTITUTIONAL ARRANGEMENTS FOR GUIDING URBAN GROWTH

Introduction

Urbanization has had a profound impact on the administrative capabilities of local government during the past 25 years. It will surely influence our entire system of government over the 1970-2020 period. Administrative forms and processes, as they relate to city and regional planning and development decision-making in the NAR, are but a part of the total governmental web in the NAR. How well our present and future governmental institutions at all levels respond to the resource and environmental needs associated with urban growth and change will directly affect the lives of the region's population.

In the past, urbanization within the NAR has proceeded in incremental, often piecemeal, ways. Airports, power stations, express highways, shopping centers, industrial parks, and major new residential developments were plunked down on the landscape with little concern for their long-range consequences and their relationship to other development activities.

A population increase of 40 million with a potential 100 percent increase in developed land, the incalculable effects of rising disposable income, and unforeseeable changes in consumption patterns

will all place tremendous pressures on our traditional methods of shaping urban development and on our processes of allocating land, water, and related resources.

The 167,000 square mile land area, and its 50 million inhabitants, are relatively well measured in terms of their existing characteristics, as revealed by the U. S. Census and various physical resource inventories. What is less well known is the administrative and urban development planning performance and capacities of the local governmental institutions within the NAR.

In addition to the 13 states and the numerous agencies of the federal government, the NAR comprises 272 counties, over 100 cities, and at least 1,500 incorporated towns and villages that directly or indirectly influence land and water use, and urban development planning. The mosaic of local government is further overlain by a noncontinuous network or special districts, special authorities and metropolitan planning agencies. When taken together, these agencies embrace a wide spectrum of urban development policy and are often responsible for a specific public service such as the construction of transportation facilities or the provision of water supply, both of which influence the location and character of urban and regional development.

Separate from, but closely interrelated with the web of governmental institutions in the NAR is the private sector that owns much of the land and makes many of the investment decisions that affect patterns of regional growth and development. This amalgam of private firms, public authorities, and governments, operating at the federal, state and local levels, represents the context within which administrative mechanisms related to urban development have evolved in the NAR. In light of the multiple crisis facing our urban areas it is obvious that new administrative mechanisms will emerge if we are to make any headway in improving our physical, social and biological environment.

Federal Inter-Agency Coordination at the Regional and Subregional Levels. During the past 25 years there has been little serious effort, and, hence, little substantive experience in federal inter-agency coordination with respect to urban development in the NAR. Great potential exists for improving administrative mechanisms and experimenting with political innovations. The President's Council on Environmental Quality reporting in August of 1970 on the state of the nation's environment, called attention to the fact that several federal policies actually promote wasteful land-use practices and perpetuate many of the environmental deficiencies associated with urbanization.

Closer program coordination between federal agencies such as Department of Transportation (DOT), Department of Health, Education and Welfare, (HEW), Department of Housing and Urban Development (HUD), Department of Labor (DOL), and Department of Interior (DOI) and others will undoubtedly be a major administrative change in the next decade.

The President, for example, has sought to strengthen and realign the regional offices of federal agencies. In New York City five federal agencies have created a vehicle for improving the effectiveness of federal programs through improved program coordination and assistance to states, localities and individuals. The Bureau of the Budget is assisting this interagency staff group in its formative period. To date, progress has been slow and its impact on urban development policy in New York and New Jersey has been slight. Federal agency participation in metropolitan planning agencies (where it is usually ex-official) and on regional compact agencies, such as the Delaware River Basin Commission, has equally great potential for improving the urbanization policy process in the NAR.

Metropolitan Planning Agencies and Processes. Metropolitan planning agencies are recent additions to the constellation of governmental institutions in the NAR. Few of them existed prior to 1960. It is to be expected, therefore, that they are still not as effective in influencing the course of urban development as more established institutions, such as state line agencies or, for that matter, local municipal zoning bodies.

Except for Rhode Island (which has a multi-agency statewide planning program but no metropolitan planning agencies) all of the states in the NAR have one or more metropolitan agencies. Altogether, there are about 45 established agencies in the NAR which have a prime responsibility for comprehensive urban development planning, traditionally with a two-fold emphasis on land use planning and public facilities planning. Their range of activities is slowly broadening, however, to include environmental planning, health planning, economic planning and some types of natural resource planning. They are a varied group of agencies, each operating within a unique geographical section of the NAR, each working under unique political leadership patterns, a variety of legislative mandates, and differing levels of financial support. It is deceptive to generalize about these agencies since some are strong and influential in the decision-making process while others are not. Some are dynamic, evolving organizations while others are static and tend to be less innovative. The important point, however, is that they all are "on the map". They have survived an initial formative stage and could play an important role in affecting future urban development policy if the state governments above them and the local governments within their areas enable them to do so.

They will not evolve into effective instruments for affecting urban growth without strong leadership. This is of crucial significance. Plans connote policies and programs which require involvement in the political process if they are to be carried out. Planning which is conceived of as only a technical undertaking is probably going to lead to little substansive improvement in our environment or to a more rational use of our resources.

Some general observations with respect to metropolitan planning agencies may be put forth for testing and possible confirmation. Many metropolitan planning agencies still lack specific, operative ties to the actual day to day decision-making involved in urban development. In lieu of developmental responsibilities, metropolitan planning agencies have concentrated on research (rather than on the formulation of programmatic action), or they have concentrated on building up their advisory and intermediary roles rather than aiming to exert a direct impact on urban development decisions. Often, the research and advisory roles go hand in hand. Many of the comprehensive metropolitan development plans that have been prepared within the NAR are highly generalized in their content and geographical scale. Many agencies face situations where the key decisions that will determine urban development patterns or the next 20 years have already been made. Finally, most agencies are still in the process of creating methods of plan implementation that will be effective, practical and equitable.

Metropolitan planning agencies in the NAR are most extensively developed where states have extended direct or indirect support. These include Connecticut, New York, Pennsylvania and Virginia. In general, the linkage of metropolitan planning agencies to water resource planning undertaken by state and federal agencies is weak at present, and could be strengthened to the mutual benefit of government at all levels. Some of the larger and more active agencies are as follows:

Agencies	Location
Metropolitan Area Planning Council	Boston, Mass.
Capital Region Planning Agency	Hartford, Conn.
Tri-State Transportation Commission	New York, N.Y.
Nassau-Suffolk Regional Planning Commission	Long Island, N.Y.
Delaware Valley Regional Planning Commission	Philadelphia, Pa.
Regional Planning Council	Baltimore, Md.
Metropolitan Washington Council of Govts.	Washington, D.C.
Richmond Regional Planning Commission	Richmond, Va.

All of these agencies are involved in land-use planning and also in planning for water distribution and sewage treatment. Long-range planning for water resources, especially from a multi-resource perspective, could and probably should be added to the work programs of most of the metropolitan planning agencies.

Selected Metropolitan Development Plans

Capital Region Planning Agency (Hartford Region)
"Proposed Plan for the Capital Region, part 1," 1964

Delaware Valley Regional Planning Commission
"1985 Regional Land Use Plan," 1968

Delaware Valley Regional Planning Commission
"1985 Regional Plans in Summary (Six plans: land use, highway, transit, water supply, water pollution control, and open space)"

Greater Bridgeport Regional Planning Agency
"Regional Plan of Development" (Map and Text), 1968

Metropolitan Area Planning Council (Boston region)
"Guides for Progress: Development Opportunities for Metropolitan Boston," 1968

Metropolitan Washington Council of Governments
"The Changing Region, a Comparison of Plans and Policies with Development Trends," 1969

National Capital Planning Commission (Washington, D.C.)
"Plan for the Year 2000," 1961

Regional Plan Association (New York City)
"The Second Regional Plan, A Draft for Discussion,)
November 1968

Regional Planning Agency of South Central Connecticut (New Haven region)
"Proposed Land Use Plan - Year 2000" (adopted May 20, 1968, Map and Text)

Regional Planning Council (Baltimore region)
"Suggested General Development Plan - Baltimore region (Map and Text), 1967

Tri-State Transportation Commission (New York region)
"Regional Development Guide: goals and plan for the Tri-State Region (New York-New Jersey-Connecticut),"
October, 1968

Metropolitan Coordination Through Councils of Governments. Councils of Governments, usually comprised of chief local elected officials in a particular metropolitan area, are an even more recent administrative response to urban pressures than are metropolitan planning agencies. They take three different forms in terms of intergovernmental relations:

Occasionally they comprise both the metropolitan planning organization and the Council of Governments.

More often they are a separate organization, with their own board of directors, but they work closely with and are often funded through the metropolitan planning agency. In such cases they concentrate primarily on improving communications between mayors and other municipal executives, and on presenting the needs of local governments before state and federal agencies and legislatures.

Elsewhere in the United States, such as in Minneapolis, and in the southwestern states, Councils of Governments, or COG's, have developed quite rapidly. In the NAR they are still in the embryonic stage, except in Washington, D.C. They tend to operate as loose federations with an emphasis on information exchange, public education and liaison between local officials. Without state and/or federal support, they cannot be much more than associations of local officials beset by the common woes of fiscal imbalance, environmental deterioration, and lack of political and social consensus on urban development issues.

Special Authorities. There are quite a few special authorities in the NAR, some statewide and some at the metropolitan level. They often have a very important impact in shaping urban growth and they are frequently well established, well financed and well managed. Port authorities, transportation authorities, sanitation districts are just some of the major types of administrative organs that have grown up over the years; but, in almost all cases, since they are single purpose authorities, they do not contribute to the solution of problems relating to interagency coordination, or to the improvement of comprehensive urban development planning. (In California, for example, they occupy strategic positions on the administrative map and can almost be considered a form of civic denial.)

State Planning at the Regional Level and at the State Level. Most state resource and planning activity is conducted at the statewide rather than at the metropolitan scale. There are exceptions, however, most notably in New England where several states have either established or given strong support to the creation of regional planning agencies. In New York regional offices have been created; however, they function basically as branch offices of the state agency.

Most state planning programs in the NAR are well developed, particularly those that are closely aligned with the governor's office. They are well financed, concentrate considerable effort on basic research and data management, and serve the state line agencies in that capacity. They have little influence on state legislatures, except through their governors, devote little staff effort to public education, and their concern for plan implementation is often secondary. In general, they do not solicit much local government input into their planning work, except in the case of the Rhode Island's Statewide Planning Program, and their programs often reflect the deep-rooted divisions between rural-oriented state legislatures and problem-plagued older urban areas.

As the political power of suburban sections within urban areas increases, and as urban problems spread to the suburbs (e.g., water supply, housing deficiencies, and environmental pollution), the responsiveness of state legislatures to urban development issues, and their willingness to resolve some of the conflicts

over resources and land utilization, may be expected to improve. A word of caution about oversimplification: much state planning goes on in state line agencies, and in state budget offices, in addition to the state comprehensive planning agency.

Interstate Planning Institutions. With the exception of several River Basin Commissions, and a few metropolitan planning agencies which have been established by interstate compacts, interstate planning organizations have not evolved significantly in the NAR and show little prospect of doing so. Within the NAR only one agency exists that includes entire states, namely, the New England Regional Commission. The NAR also contains a portion of the area under the jurisdiction of the Appalachian Regional Commission. Neither of these agencies has as a primary concern the resolution of policy questions raised by urbanization, nor do they attempt to influence urban development patterns.

River Basin Commissions, such as those established in the Delaware and Susquehanna Basins, have great potential in the NAR, especially those in which the federal government is an equal party with the participating states. They could act as the vehicle in bridging the gap between land use planning and water resource planning. Given adequate financing, they could also bridge the gap between plan preparation and plan implementation through direct investment of public funds in urban infrastructure. Action on the Hudson River and the Connecticut River is presently suspended because of lack of agreement between the participating governmental bodies, but the potential for administrative development exists. Once created, such agencies could exert a substantial impact on water resource policy as well as urban development policy within their respective basins.

Needed Changes in Institutional Arrangements Relative to Urban Development Planning. Which institutional arrangements and administrative structures have proven to be most effective, accountable, innovative and consistent with regard to urbanization policy and urban development planning in the NAR? Which ones seem to have greatest potential for effectively guiding urban growth in the future? The answer is: probably those administrative structures that strike a balance between state and local government participation. The future federal role in affecting urban development policy within the NAR is unclear. At present, active federal participation seems to be largely absent and is most in need of formulation and experimentation.

To better deal with the population increment of 40 million and the enormous area of land development anticipated in the NAR, critical changes are needed in our different systems or layers of government and in intergovernmental relations. These changes resolve around the following:

To achieve the threefold objectives related to national efficiency, regional development and environmental quality, the

effectiveness of public planning and policy making must be strengthened. Furthermore, the public planning function must be better related to the private sector which, in fact, builds most of the region. This can be done in the NAR. The President's recent call for a national urban growth policy may be the new beginning of what was initiated in the late 1930's and early 1940's, but was halted with the abandonment of the National Resources Planning Board and the onset of World War II.

Resource and land use decisions at the local scale are still not sufficiently balanced against their metropolitan and regional consequences. For example, the cumulative effects of exclusionary zoning in suburban areas has a drastic effect on the housing and employment opportunities of low-income groups. Development tools, such as zoning, can no longer be exercised exclusively by local government. A mechanism for state involvement in local housing policy, for example, has been initiated in Massachusetts and may prove effective with respect to other issues related to natural resources such as wetlands within metropolitan areas. Recently enacted legislation in a number of other NAR states including Maine, Vermont and New York has also strengthened the ability of the state to control development.

The lack of program coordination among federal agencies and the inconsistency of federal policies concerning urban development in the NAR must be reduced as much as possible. Strengthening the role of the regional offices may help in this respect.

Short-run costs and benefits of land and resource development decisions must be better weighed against long-run costs and benefits. Linking state and municipal budgetary process to urbanization policy might represent a partial solution. (Whereas the economic consequences of alternative land use decisions can be calculated for agricultural development, we are far less able to demonstrate the economic consequences of alternative urban development patterns. Much more work is required in this area.)

Metropolitan planning structures and processes in the NAR need additional refinement and sophistication. Such evolution will require time as well as support from the state and federal government. Metropolitan planning agencies must also devise the means for increasing their accountability to the citizens who carry the costs and receive the benefits associated with urban growth and urban change. At present, they tend to be isolated from the public as well as from the mainstream of development decision-making.

INSTITUTIONAL ARRANGEMENTS FOR LAND DEVELOPMENT

The political structure of the NAR in general is such that local government authority is vested in towns, cities, boroughs or counties. Most of the governmental units have planning commissions or conservation commissions to deal with the problems of land and water development. It is difficult to develop land and water on a broad areawide scale with a multiplicity of small governmental units making land use decisions.

Some county governments have planning and zoning commissions that aid in making land use decisions on a larger scale than municipality or home rule. Land and water resource development on a county or multicounty basis can include total watershed planning and can incorporate information and recommendations from various federal and state governmental agencies. Assistance can be provided through voluntary participation programs to help solve the problems of soil stability for building, drainage, water supply, sewage disposal, recreation, aesthetic improvement, resource management and erosion control related to the land and water resources. Through a combined effort, all governmental agencies can cooperate in the planning, engineering implementation and landscape phases of land and water resource development.

Water and related land resource programs are carried out under an effective federal-state-local cooperation with the major portion of decision making carried out by local and state agencies. Federal involvement is in the role of assistance.

Local conservation districts with the assistance of the federal government can represent all the people and all the community interests in determining conservation needs and responding to the desires of the residents; develop conservation and resource programs for all the people; involve all the people through appropriate representation in the decision making process relating to natural resource conservation and development.

In rural areas, factors which tend to prevent the application of conservation measures from being installed on the land include:

Lack of knowledge or the unwillingness of the resource users to recognize the importance of the conservation effort.

Uncertainty of land tenure, which reduces the expectancy of returns from conservation investment and the uncertainty of future prices.

Securing long term rights to the use of land is an incentive to invest in conservation where both economic and aesthetic rewards will be realized. Federal assistance should be encouraged to increase the tenure security of the land user. These can be achieved through tenancy arrangements, farm credit, commodity pricing, taxing policies and crop insurance.

Some states in the NAR have created Regional Planning Commissions whose memberships are comprised of representatives of cities, towns and boroughs in the region. Generally, Regional Planning Commissions are financed by state appropriation but they must rely on the cities and boroughs to implement the recommendations. The establishment of Regional Planning Commissions provides for collaboration by the many governmental agencies that deal with water and related land resources on a local level, with the Commission having the authority for the

whole area. The Federal Government should assist these commissions in regulating the use and occupancy of flood protection.

Interstate compacts provide cooperation for planning across state lines. Various other organizations such as Flood Control Commissions, Interstate Water Pollution Control Commissions, and Forest Fire Protection commissions can provide some planning and development on a broad scale.

Joint State-Federal legislation has been enacted to provide for river basin commissions and river basin studies that may encompass an entire river basin or many river basins in a region. The studies vary in intensity from broad comprehensive framework studies (Type 1), which identify regional needs and alternative solutions, to more detailed surveys on single river basins or states (Type 4).

Federally owned or managed lands are authorized by Congress for the provision of recreation, timber production, watershed protection, national defense, unique and aesthetic area preservation, grazing and wildlife protection and management.

Programs for Urban Planning and Development 1/

Introduction

The keystone of HUD's approach to solving urban problems is comprehensive planning as a device for guiding local, regional and state decisions concerning community development.

HUD fosters comprehensive planning by making grants to local, regional, and state comprehensive planning agencies, to assist in their planning activities, and by requiring comprehensive planning as an essential element of the Workable Program for Community Improvement and as a prerequisite for HUD assistance for urban renewal, water and sewer facilities, new communities, Model Cities, and open space programs.

Community Renewal. Grants are made in amounts of up to two-thirds of the cost of preparing, completing or revising a Community Renewal Program, a community's renewal strategy covering the full range of urban renewal action required to meet local needs. A typical CRP develops information and programs of action concerning need for renewal, its economic basis, renewal goals, and resources available to accomplish these goals.

Historic Preservation. Matching grants are provided to cover up to 50 percent of the cost of acquiring, restoring, and improving sites, structures, or areas of historic or architectural significance in urban areas, in accord with comprehensive local planning.

1/ Program descriptions are from U. S. Department of Housing and Urban Development, HUD Programs, Washington, D.C., June 1969.

Projects must result in a public use or benefit. Applicants must assure maintenance and continued use of the property for historic preservation purposes.

Interim Assistance for Slum and Blighted Areas. Grants are made to assist localities in taking interim actions to alleviate harmful conditions in slum and blighted areas. Generally, these are areas for which substantial clearance is planned in the near future but in which some immediate public action is needed until permanent action can be taken.

Land Development and New Communities (Mortgage Insurance). Mortgages to finance the purchase of raw land and the development of improved building sites or to finance the development of new communities are insured by the Federal Housing Administration in amounts up to $25 million for any one project. Repayment periods, except for mortgages covering new communities or sewer and water systems, may not exceed 10 years.

Model Cities. Grants are made and technical assistance is provided for cities to carry out comprehensive programs attacking the social, economic, and physical problems of blighted neighborhoods in selected localities. Cities are required to use and coordinate existing federal grant-in-aid programs and state, local, and private resources, and to involve neighborhood residents in planning and executing comprehensive five-year plans.

Neighborhood Development. Neighborhood development programs consist of urban renewal project activities in one or more urban renewal areas, which are planned and carried out on the basis of annual increments. This enables communities to proceed simultaneously with actual renewal of areas requiring immediate action and with detailed planning and scheduling of subsequent redevelopment, rehabilitation, and public improvements.

New Communities. Bonds, debentures, notes, or other obligations issued by private developers to finance the cost of acquiring and developing land for new communities may be guaranteed by HUD. Within a limit of $50 million for any one community, and based on HUD's estimate of value and cost, the guaranteed amount may be up to whichever is less: 80 percent of the value of the property when land development is completed; or the sum of 75 percent of the value of the land before development and 90 percent of the actual cost of the land development (not including buildings).

Open Space Land. Grants of up to 50 percent of costs involved in acquiring land for open space use, and further grants of up to 50 percent of improvement costs for developing the land are made. Acquisition and development of the open space land must be in accord with local and areawide comprehensive planning. A grant to acquire developed land in a built-up urban area may be made only if there is no suitable undeveloped land in the same area.

Public Facilities. Loans for up to 40 years and covering up to 100 percent of project cost are made for use in financing a variety of public works projects - construction of water and sewage facilities, gas distribution systems, street improvements, public buildings (except schools), recreation facilities, jails, or other public works.

Public Water and Sewer Facilities. Grants are made in amounts of up to 50 percent of land and construction costs for new water and sewer facilities. The facilities must be consistent with a program for a coordinated areawide water and sewer facilities system which is part of the comprehensively planned development of the area.

Surplus Land for Community Development. Established federal programs are used to demonstrate a joint public-private capability to create total new communities and neighborhoods, rather than just more housing projects or residential subdivisions. Such communities will offer housing, as well as a full range of facilities for education, recreation, parks, shopping, religious observance, and public services to citizens of various income levels and racial backgrounds.

Urban Beautification and Improvement. Grants are made to expand community activities in beautifying publicly owned or controlled land in urban areas. These grants may be up to 50 percent of the amount by which the applicant increases expenditures for beautification activities above the average amount of such expenditures for the preceding two years. The grant may be used for park development, upgrading and improvement of malls and similar public areas, street improvements, and the beautification and improvement of other public places. The beautification activities must be capable of providing long-term benefits.

Urban Mass Transportation. Grants of up to 100 percent of the cost of research, development, and demonstration projects, up to two-thirds of the cost of technical studies, and up to 100 percent of eligible costs for university research and training in the urban transportation field are made.

Urban Renewal Projects. Grants, planning advances, and temporary loans are made to help finance blight elimination through surveys and planning, land acquisition and clearing, rehabilitation of existing structures, new building construction, and the installation of public improvements.

Workable Program for Community Improvement. To quality for the following federal aids a community must be carrying out an official plan of action that is certified by HUD as a Workable Program for Community Improvement, and that involves public and private resources to eliminate slums, prevent blight, and foster local development; grants for concentrated code enforcement projects, and for demolition of unsound structures; grants for urban renewal;

mortgage insurance for private housing financed under FHA's below-market-interest-rate provisions and under its special urban renewal housing program; loans and annual contributions for public low-rent housing; loans and grants for rehabilitation both inside and outside urban renewal and code enforcement areas; loans and grants for neighborhood development in one or more urban renewal project areas; and grants for interim renewal programs in areas where major renewal is planned.

Flood Insurance. For those communities applying for and meeting HUD's eligibility requirements, HUD is authorized to establish a program of flood insurance, as a joint venture between the federal government and the private insurance industry. Insurance policies will be sold by and the risk will be shared by the private insurance industry. Initially, flood insurance will be available for one- to four-family residential properties and, as soon as rates can be developed, for small business properties. Later, other classes of property may be eligible. On existing properties in an area identified as a flood-hazard area and for which rating studies have been completed, the owner will pay a subsidized rate of insurance and the Government will pay the difference between the subsidized rate and the full premium rate. On properties constructed or rebuilt in such areas, after identification of the flood hazard, the owner will pay the full premium rate. Federal reinsurance against heavy losses will be provided to the insurance industry. Where the State, county or community has established eligibility for the Flood Insurance Program, the program requires the adoption and enforcement of measures to restrict the future development of land that is exposed to flood hazards.

Equal Opportunity in Housing. Racial discrimination in housing of any size or description is a violation of the Civil Rights Act of 1966. In addition, the Civil Rights Act of 1968 contains a Federal Fair Housing Law (Title VIII) which establishes fair housing as the policy of the United States. This law prohibits discrimination on the basis of race, color, religion, and national origin.

Community Development Training. Matching grants of up to 50 percent are made to states to help them provide special training for professional, subprofessional, and technical personnel employed or to be employed in the fields of housing and community development by state or local government and by public or private non-profit organizations.

HUD Clearinghouse Service. The HUD Clearinghouse Service provides a national focal point for the collection, dissemination, and exchange of technical assistance and information for federal, state, and local governments, universities, and private organizations. Information may relate to subjects such as HUD and other federal programs, the results of research, studies, and demonstrations, and urban-related programs and activities of state and local governments and private organizations.

Urban Information and Technical Assistance. Matching grants of up to 50 percent are made for activities designed to improve the public administration capabilities of communities under 100,000 population.

Comprehensive Planning Assistance. Grants of up to two-thirds (three-fourths, in some instances) of the cost of a planning project are made to supplement state and local funds for comprehensive planning for areas having common or related development problems.

Eligible activities include the preparation of development plans, policies, and strategies; implementation measures; and the coordination of related plans and activities being carried on at various levels of government. A broad range of subjects may be addressed in the course of the comprehensive planning process. They include land development patterns, physical facility needs, such as housing, transportation planning, recreation and community facilities, the development of human resources, and the development and protection of natural resources.

Planned Areawide Development. Grants of up to 20 percent of project costs are authorized to supplement federal grants made under any of 10 other federal grant programs for the following types of projects; basic water and sewer facilities, libraries, hospitals and medical facilities; sewer treatment works, highways, airport development, urban mass transportation facilities and equipment, acquisition and development of land for open space, urban beautification, and improvement, historic preservation, acquisition and development of lands and waters for recreational purposes, and public works and facilities in redevelopment areas. The total federal contribution may not exceed 80 percent of project costs.

Urban Planning Research and Demonstration. Grants covering the full cost of a project may be made. The project may include activities necessary to develop and test new methods and techniques through experiments in actual practice; or it may consist of studies or research related to solving urban problems, revising state statutes regulating local government, or improving comprehensive planning generally.

Rural Programs

Soil Conservation Districts. Approximately 97 percent of the NAR area is in Soil Conservation Districts. These Districts are legal units of government organized under state laws. The laws under which the Districts function may differ by states but all are based on the principle that local landowners and operators have the responsibility of directing local conservation programs.

The major goal of all districts is to assist cooperators in the preparation and implementation of complete conservation management and land treatment measures for all the land in the district. Urban land as well as agricultural and forest land receives conservation planning and treatment.

In the NAR there were 109,368 landowners, operators or land users having basic conservation plans covering 16,683,623 acres as of July 1, 1967.

Agricultural Stabilization and Conservation Service Programs. The Agricultural Stabilization and Conservation Service (ASCS) is the agency of the USDA which carries out various farm action programs in the general fields of production adjustment, conservation financial assistance, and price, market and farm income stabilization. The agency carries on its work with the aid of state, county and community farmer committees and includes much of the operations of the Commodity Credit Corporation.

The principal ASCS activities in the NAR include conservation assistance through sharing with individual farmers the cost of installing needed soil, water, forest and wildlife conserving practices under the Rural Environmental Assistance Program (REAP). The technical assistance for the REAP is provided by the USDA technical agencies.

Resource Conservation and Development Projects. This program provides technical, financial, and loan assistance on a limited basis to local legal sponsors in approved areas where acceleration of going programs of resource conservation, development and utilization will increase economic opportunities for local people. The program provides local leadership with the opportunity to coordinate and utilize local, state and federal facilities and techniques more fully in planning and carrying out a balanced program of land conservation development and utilization and in determining alternate uses of land and water resources in open spaces.

Included are technical help through the Conservation and General Forestry Assistance Programs to develop water resources, update soil surveys, accelerate conservation practices on private ownerships, convert cropland to such uses as grass, trees, wildlife or recreation use, improve facilities, attract new industries and improve markets for all products and services of the land. Within the NAR there are 10 RC&D projects in various stages of advancement.

Watershed Protection and Flood Prevention. The SCS is responsible for administering Public Law 566 Watershed projects. These projects are for the purpose of flood prevention and water management including such purposes as drainage, irrigation, recreation, municipal and industrial water supply, fish and wildlife development, water quality and other purposes.

The SCS in cooperation with federal, state and local agencies assist local organizations in making preliminary investigations, and preparing work plans. FS is responsible for the forest land multiple use management phase of the PL 566 program.

Comprehensive River Basin Planning. River Basin planning was authorized by the Congress through enactment of the Water Resources Planning Act (PL 89-80). This Act established the Water Resources Council, authorized establishment of River Basins Commissions and

provided for financial assistance to the states to increase state participation in coordinated planning of the nation's water and related land resources.

In addition to the NAR Type 1 comprehensive study, two Type 2 and two Type 4 studies (in greater detail than Type 1), are presently underway. Type 2 studies are the Susquehanna and the Connecticut River Basins, and Type 4 studies are the Massachusetts Water Resources Study and the James River Basin.

Soil Surveys. Soil Surveys provide detailed information that can be applied in managing farms and forests; in selecting sites for roads, ponds, buildings or other structures; and in determining the value of tracts of land for agriculture, industry or recreation.

Soil scientists study the color, texture, structure, consistence, and thickness of different soil layers. Soils are tested for permeability, reaction, plastic limits and other characteristics. The effects of these characteristics are observed and interpreted for all kinds of uses and methods of soil and land management. All soils are classified according to the national system of classification which permits research and experience to be projected from one place to another without duplication.

General Forestry Assistance Programs. General Forestry Assistance Programs (GFA) carried on within the Region are divided into four general areas: (1) Rural Area Development, (2) Resource Development, (3) Manpower and Economic Development, and (4) Consulting Services.

In Rural Area Development the aim is to help rural people help themselves. This is being done through the efforts of Rural Development Committees which are organized on a state, regional multicounty and county area within the NAR. GFA participation in Resource Conservation and Development projects has been described previously.

The Manpower and Economic Development phase of the GFA Program is carried out through federal-state programs in the general field of manpower, sociology and economic development. The two most important programs are Cooperative Area Manpower Training System (CAMPS) and GFA's involvement in the program of the Economic Development Administration in an advisory capacity in applications for loans pertaining to forest product industries.

The consulting services aspect of GFA Programs consists of supplying forest landowners with information on a "how to do it" basis. The service provided is in the fields of multiple use management, continuous forest inventory, problem solution, training, data processing, and economics.

Forest Tree Production and Distribution. Through Section 4 of the Clarke-McNary Act of 1924, financial assistance is provided to states to grow and/or distribute forest tree seed or planting stock at cost or below cost for reforesting idle, denuded or understocked forest lands. Ornamental and shade tree planting stock is excluded from the program.

Forestation Assistance. Technical and financial assistance is offered to the states by Title IV of the Agricultural Act of 1956 through State Foresters in the forest tree planting on non-Federal lands.

Cooperative White Pine Blister Rust Control. By the Lea Act of 1940, Public Law 486, technical and financial assistance is offered to the states through cooperative agreements with the FS to protect white pine stands from the white pine blister rust disease.

Cooperative Insect and Disease Control. The Federal Forest Pest Control Act of 1947, Public Law 110, offers technical and financial assistance to the states cooperating with the FS to protect forested areas from serious insect and/or disease outbreaks.

Cooperative Forest Fire Control. Section 2 of the Clarke-McNary Act of 1924 provides professional and financial assistance to states in the protection of non-Federal forest land from fire. States administer the protection programs and are reimbursed from Federal funds up to 50 percent of expenditures.

Forest Management. Under the Cooperative Forest Management Act of 1950, financial and technical assistance is given to the states in helping private forest landowners and operators with the management of forest lands and the harvesting, marketing, and processing of forest products.

Forest Service Research Program. The FS maintains research facilities at five locations within and eight locations immediately adjacent to the NAR. They are all concerned with the problems and needs of the forested areas of the Region. The various research programs involve watershed, wildlife habitat, recreation, silviculture and timber management, economics and marketing, and insect and disease research. Watershed research is concerned with the correlation and synthesis of watershed characteristics and management techniques in regard to managing storm runoff; improving the quality and quantity of water yield, and limiting streamflow extremes - flood and low flows - through vegetation manipulation. It is also concerned with strip mined areas and practical methods of restoration.

National Forest Development and Multiple Use Program. The National Forest Development and Multiple Use Program, in addition to providing watershed protection and management, also includes

timber production, recreation development and fish and wildlife habitat improvement under the multiple use concept.

Watershed Protection and Management. The objectives of watershed management on the National Forest are the protection, conservation, and use of the natural resources of a drainage basin to keep the soil mantle in place and to make water available which best serves human requirements. More specific objectives are to (1) maintain and improve water quality, (2) reduce flood peaks, (3) augment low flow and (4) perfect and use techniques for increasing water yield. Each objective requires careful consideration in execution of plans to obtain optimum management of forest land for their total contribution to public and private needs and opportunities.

Water quality is a primary consideration in all land management activities and is monitored in order to identify the effect of any pollution sources.

In watersheds with a history of flood damage, every effort is made to perfect and use management techniques to reduce flood peaks. Known flood plains are designated within the water influence zone which requires special resource management considerations. On watersheds for which a need for flow augmentation is shown by watershed analysis, vegetative management techniques are used to accomplish this goal. When the need arises, studies are initiated and techniques used for increasing water yield.

Barometer watersheds have been established within the Region. The "barometer" watershed program is a national program to provide the basis for determining the effect of management practices on hydrologic behavior. Its purposes are to bridge the gap between the laboratory and the managed watershed and to establish a permanent means of measuring the individual and composite effect of many changing and fluctuating activities on the quantity, quality and timing of water yields. Climatic stations, precipitation gages and stream-gaging stations measure the input and outflow of water to accomplish the objectives of the "barometer" watershed program.

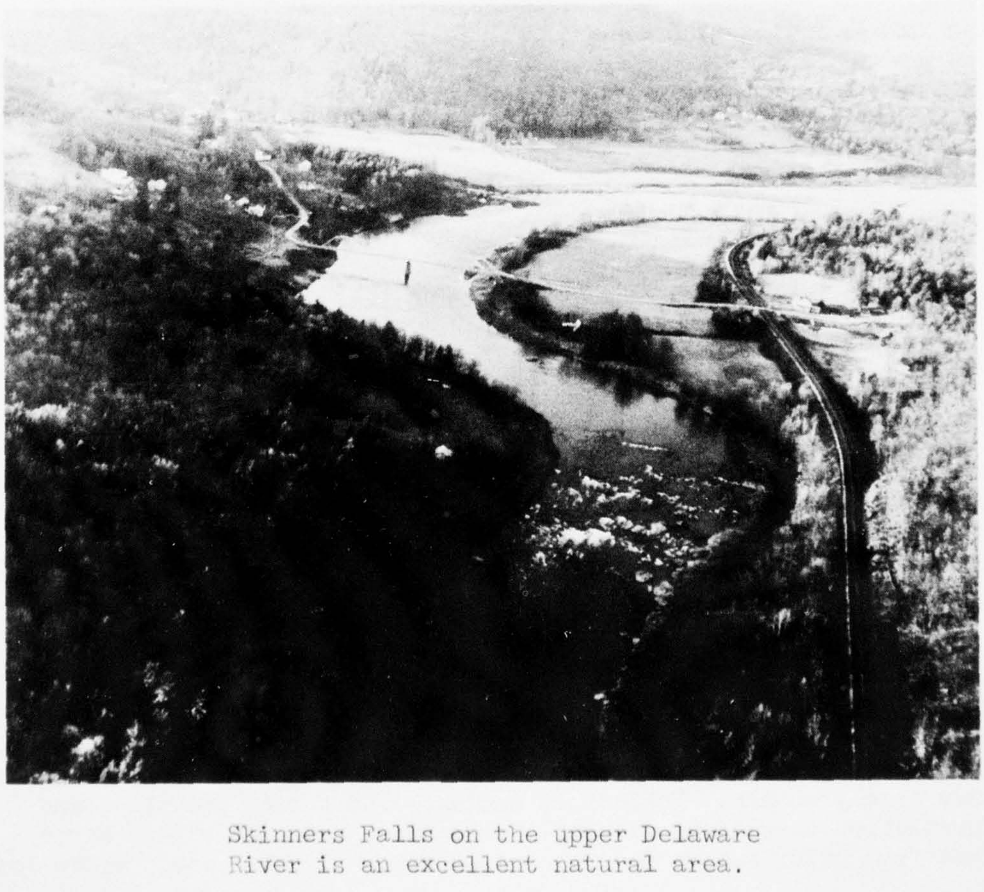
Wild and Scenic River Studies. The Wild and Scenic Rivers Act (PL 90-542) designated three rivers in the Region for study and possible addition to the National Wild and Scenic Rivers System. Study of a river may result in a recommendation for designation in one of three categories: Wild, Scenic, or Recreational, or for exclusion from the system.

The Allagash Wilderness Waterway, Maine, was included in the original Act as a state river in the National system upon application by the State of Maine. The three rivers proposed for inclusion in the system are the Upper Delaware, New York and Pennsylvania; Pine Creek in Pennsylvania; and the east and west branches of the Penobscot River in Maine. The Upper Delaware is presently under study and the Penobscot and Pine Creek are scheduled for study in 1972.

The Bureau of Outdoor Recreation (BOR) has leadership responsibility for those rivers outside of National Forests. The FS represents the USDA in the BOR led studies. Other agencies such as SCS, ERS, ASCS, State and local governments contribute to the overall input in determining the desirability of a river becoming a part of the National Wild and Scenic River System.

States are also working on wild and scenic river systems which would be managed and protected similar to the Federal System. Some of the rivers could be in both the State and Federal River Systems. Some rivers could also be jointly managed.

Additional rivers listed by the Secretary of Interior and the Secretary of Agriculture on September 11, 1970 require evaluation for possible inclusion into the Wild and Scenic River System when they are considered for other uses or are affected by another river study. Seven rivers in the NAR fall into this category at this time. They are the Cacapon in West Virginia, Shenandoah in West Virginia and Virginia, Rappahannock in Virginia, Pocomoke in Maryland, Mullica in New Jersey, and the Upper Hudson and Beaverkill in New York.



Skinners Falls on the upper Delaware River is an excellent natural area.

CONCLUSIONS

The NAR contains an abundance of natural resources. The region covers a total area of 105,736,000 acres. Present land use is about 15 percent cropland, 6 percent pasture, 66 percent forest and 13 percent other and urban land.

The topography of the region is composed of a series of low mountainous ridges separated by narrow fertile valleys leading to coastal plains with tidal streams. Adequate moisture through the region provides a vegetative cover that is primarily forest. The varying topography is enhanced by the forest being interspersed with cropland, pasture, city and town. However, the landscape is increasingly subject to man's impact. Eighty percent of the Regions 50 million people live on six percent of the land. The expanding population will continue to compete with agriculture for the more productive land.

Rural Land Use

The trend to more urban and less rural population is expected to continue. The farm portion of rural population is expected to decline significantly. In 1960, nearly 81 percent of the population was urban. The NAR is the most densely populated area of its size in the United States with a regional population density of approximately 264 persons per square mile. It is evident that population pressures will continue to have a significant impact on land use in the region. When competition for land and water resources is intense planning for the use of the resources to meet human needs and desires assumes greater importance.

Shifts are expected to occur for all land uses. Cropland and pasture is expected to decrease in favor of urban and other land. Forest land acreage is expected to remain relatively stable with some shifts of better land to urban development.

Linear Programming Analysis

Analysis of land use reveals an abundance of land physically available to meet current and future demands should it be properly managed. However, population and resource use shifts will create localized problems. The analysis presented earlier in this Appendix gives indication of the most critical problem areas and selected planning alternatives.

Meeting the planning objective of efficiency of production could be accomplished, given necessary shifts in production patterns. Institutional rigidities rather than production capability are the major constraints. Analysis of the L/P model reveals current production patterns are 36 percent less efficient than if land resources were freely mobile. Inflexible zoning, land taxing practices and speculation as well as personal preferences and life styles keeps land from being put to its most efficient productive use. Since land

is not a mobile resource, planned land use change and/or improved management are the only practical means of relating availability to demand in an efficient or desirable manner. Projections give indication of the location and magnitude of the demands in the future. Planning provides the vehicle to achieve greater benefits from the resource base.

Meeting the environmental quality objective presents different problems. Should the historical trend in the production of food and fiber continue, the current desirable contrast of cropland, pasture, forest, town and city will disappear before the target date 2000. Land use shifts of this magnitude will appreciably reduce the visual quality of the Region. Analysis with the L/P model reveals production and visual quality maintenance is obtainable on essentially the same number of acres but through a better distribution of land use with approximately a 69 percent increase in production costs. Again, the objective is obtainable given society's desire to pay the difference and initiate action to plan and manage the resources.

Meeting the regional development objective presented an opportunity to evaluate urban and other development if zoning were utilized to maintain agricultural production on the better suited lands, reserving urban and other development to the lower or poorer land classes and an alternate evaluation of continued development in the historic patterns. In either case, land is available; however, agricultural production costs are increased considerably if current urban and other development trends continue. Once again, the objective is obtainable with a known cost to society, given its choice in future urban and other development patterns.

Agricultural Land

A decline in acreage of all principal crops in the NAR has been compensated by increased yields through improved technology. The average size of farms has increased and is indicative of inefficient units ceasing to operate and being absorbed by large units. Not only has there been a loss of land for agricultural purposes, but also a loss of people directly or indirectly dependent on the land as a source of income. Man-year labor requirements for agriculture in the NAR is expected to decline 23 percent by 1980. Fewer people will work on the farm acre, but the acre will be called upon to do more, hence it will need to be better protected from erosion and flooding losses.

Country living offers a preferred life style for many people; rural non-farm populations are increasing in absolute numbers. The number of people owning a second home, (or just land) in a rural area is increasing. Demands are placed on agricultural lands other than the traditional principal function of efficient food production. Open fields are needed to provide a visually pleasing landscape, spaces to roam, wildlife refuge, habitat for game, grain and forage for domestic animals, cropland to till, garden space, and pasture for horses. Management is required so that agricultural lands can provide multi-purposes.

Forest

In spite of the great concentration of population in the NAR it remains a region two-thirds covered with its original forest. But the characteristics and condition of the forest cover have changed dramatically as the result of three centuries of exploitation. The rapidly expanding population with its growing awareness of its need for open space and of the inter-relationships of man's activities and his environment, is demanding and will with increasing emphasis demand that more careful treatment be applied this major portion of our land. The old "balance of nature" concept is receiving new recognition couched in popular terms new to the general public, such as "eco-systems", and "environmental quality." The old command that man go forth and subdue the earth, and the idea that the earth and everything on it were created only for man's use, are being tempered with the realization that communities of other living things have not only intrinsic values but are vital to man's well being.

While publicly owned forest land has for many years been managed for values in addition to wood products, it is becoming increasingly important that privately owned land also be managed for public values. While these lands form the watersheds from which flows most of the water we use, private owners now have no tangible incentive to manage their lands for the benefit of the downstream user. Recreation value and use of private lands form an insignificant fraction of its potential. The same is true of its potential for wildlife populations, for natural beauty, and for other aspects of our environment that contribute to a pleasing and satisfying life.

The traditional emphasis on the use of forest land as a source of wood products is subject to many changing factors, including the economics of growing wood against importing raw materials or finished products, or using substitutes. Consumers' individual tastes in materials constitute another factor. Individual interest of land-owners is another; the owner with primary interest in recreation, a summer home, investment, wildlife, or aesthetics may have no interest in wood production.

Today's demands do not afford, in the best public interest, the luxury of land producing a small fraction of its potential for any use. Tommorrow's demands will be many times more critical.

Land Treatment

The inventory of land capability classes indicates that 33 percent of the land in the NAR, is in Class I, II and III. These classes include the better lands that have the fewest management and conser-vation problems. The balance of the land needs intensive treatment and management.

Within the 105 million acres in the region, there are 32 million acres that have erosive soils, 17 million acres that have a wetness hazard, 48 million acres have unfavorable soils and the remainder

has few limitations or is unclassified. Nearly 35 percent of the land has been treated with conservation practices or is not feasible to treat. With resource development moving ahead, it is essential to accelerate the rate of accomplishment of land treatment measures in the region.

Programs are needed to control erosion in expanding urban areas where high sediment production is occurring. Accelerated treatment is needed to combat flooding, erosion and sedimentation; improve water quality and sanitary landfill areas; reclaim mined excavations and restore visual quality of the deteriorating environment.

Urban Land Use

Within the next fifty years, the North Atlantic Region will double in population and area of developed land. This growth will pose a major challenge to effective land planning and management at all levels of government, for while some patterns of urban growth rank high in meeting efficiency and environmental quality objectives, others are wasteful of resources and values.

In addition to effecting land requirements and the quality of life, the pattern of urban growth will influence the quantity and quality of water that will be needed for industrial, municipal, and visual and cultural purposes. Similarly, urban development, whether dispersed, clustered or highly concentrated, can be expected to have an impact on the planning and management of water distribution systems within the expanding metropolitan areas of the NAR.

Despite the volume of urban construction that has occurred in the post World War II period, little fundamental variety has been introduced into the range of community choice available to most low and middle income groups. Widening this range of choice through the application of advanced building and transportation technologies should be a key objective in planning for the future of the region. A highly sophisticated and mechanized building industry could affect economies in land consumption and, indirectly, in water consumption and improved water quality. Support for new community development by the federal government and growing private corporate interest in central city rebuilding and outer area development, if sustained and expanded, could be forerunners of a new era in American city development.

If improved technology and efficiency is to be achieved through innovations in the private sector, parallel advances are called for in the public sector, particularly in the sphere of federal and state inter-agency program coordination within metropolitan areas. Equal emphasis must be accorded to means for improving and advancing land development practices. This is primarily a local problem since the administrative and regulatory measures that guide land development are devised and enforced almost exclusively by counties, municipalities and towns. Achieving a reasonable degree of conformity between local development practices and regional development objectives is one of the most urgent, and certainly one of the most difficult problems facing the states of the NAR.

Physical Features and Urban Growth

Despite wide variation in landform and topography, physical features offer few serious constraints to development between the Appalachians and the Atlantic margin. Hence, the future "shape" of urban settlement in the NAR will be determined by man-made decisions rather than by any imperatives of the natural environment.

Existing Settlement and Population Distribution

The highest density of population in the NAR occurs at estuarine and tidewater locations along the region's northeast-southwest axis. Here, a series of metropolitan areas radiate out from a dozen major metropolitan cities between Washington and Boston. With densities ranging between 10,000 and 25,000 persons per square mile, these cities and their suburban counties account for about 62 percent of the NAR's total population.

Around the central cities of the metropolitan belt are the older suburban areas, ranging in population density from 1,000 to 10,000 persons per square mile, with a less dense, outer exurban area composed of municipalities with population densities of from 100 to 1,000 persons per square mile. What happens along this exurban frontier will largely determine the shape of the region in the next fifty years, for it is here that lower land costs and easier land assembly will inevitably attract new housing and industrial development.

Metropolitan Growth and the Central Cities

The population redistribution occurring within metropolitan areas has coincided with an acceleration in the long-term trend of the suburbanization of those economic activities traditionally providing employment for unskilled and semi-skilled workers. The growing incongruity between central city job mix and resident labor force composition has acted to exacerbate many of the chronic problems of city life.

In those suburban locations that are absorbing larger shares of metropolitan manufacturing employment, powerful social restraints exist against the suburbanization of black in-migrants. Not only do they face discriminatory practices in housing, but they also suffer from low incomes. Most would-be Negro workers are in no position to purchase single family tract homes even if racial barriers were absent, and since much suburban zoning prohibits multiple family housing, the opportunities for migration are exceedingly slim. Caught between contradictory economic and social forces, the region's largest cities face a crisis in fulfilling their historic function of assimilating the most recent generation of migrants and their offspring into the economic mainstream.

In devising a strategy for urban growth within the NAR, this bundle of issues looms large, with implications for a wide range of public programs including metropolitan mass transportation, federal tax measures for housing, recreation and open space, and programs for new

community development. All things being equal, those actions that promote economic decentralization without reference to the concentration of minority population in the central city act to compound the difficulties of integrating the region's black and Puerto Rican populations into the NAR's expanding urban economy. Random decentralization, however, with its associated pattern of urban sprawl, has negative implications not only for minorities, but for the population as a whole.

The Urban Crisis

Urban growth in the NAR, as in the rest of the country, is characterized by the long-term trend toward increased per capita consumption of land. Although some counter trends are appearing, the great expanse of urbanized areas consists of small structures and minispaces. There is little to indicate that any sharp departure from this pattern will occur without strong and conscious public action. The prospect of over 40,000,000 additional people in the NAR by the year 2020, simply as an extension of the present pattern, may be expected to increase exponentially the multiple crises now confronting most of the region's cities and metropolitan areas.

Faced with soaring costs for public services and with fixed or declining tax bases, more cities are turning toward the states and federal government for supplemental sources of revenue. In this regard, however, the region's central cities are not alone in their plight, for the suburbanization of population has also brought the suburbanization of problems. The transportation crisis, the environmental crisis and the civic crisis are in varying degrees making themselves felt throughout urban America. But the cities of the NAR, among the oldest in the nation, have been particularly hard hit.

Availability of Land for Urban Development

Despite the doubling of population within the forecast period, there is no evidence of a scarcity of land for urban growth within the NAR as a whole. Even under assumptions of maximum dispersal, urban development will account for only 13.6 percent of the NAR's land area by 2020. This finding, however, needs qualification for it is not consistently true throughout the region. The sheer size of the NAR and its division, for purposes of this study, into river basins tends to mask certain micro-scale problems that are so important in real life.

While the WRA's and the Urban Subregions are considerably more useful for urban analysis, it has been impossible, within the scope of the project, to rigorously evaluate the effects of regional growth on land resources within these smaller areas. Nevertheless, there is good reason to believe that conditions of moderate to high land saturation will occur in many Urban Subregions within the coastal or metropolitan belt should present trends continue.

Water and Urban Development

The Waterfront as an Economic and Aesthetic Resource to the City

Protected harbors, afforded by the estuaries and embayments of a drowned shoreline, were early assets that the seaboard cities of the NAR capitalized on in their rise to economic preeminence. As connecting links between Europe and the American hinterland, their port functions stimulated commercial growth and the development of manufacturing, oriented to serving the sea trade.

While the port function remains a vital one today, competing forms of transportation as well as the declining importance of waterfront locations to manufacturing industries has resulted in the obsolescence and semi-abandonment of miles of water frontage in the principal coastal cities of the NAR. Herein lies one of the greatest opportunities to rebuild the central cities, taking maximum advantage of the visual, aesthetic and cultural values afforded by water in the city.

New York City has 578 miles of waterfront, Baltimore has 40 miles, Newark 13, Philadelphia 24, and Boston 25 miles. These water edges and surfaces constitute the largest unexploited opportunities to create visually exciting settings for new inner core housing and community facilities. The water surface might also be regarded as a major open space that could provide rich recreational opportunities within an area normally served by public transportation, and often, within walking distance of the central city's most deprived neighborhoods.

Water as a Recreational Resource

With its characteristically hot and humid summers, water is a necessity, not only to air-condition the offices of central city businesses, but to cool the residents of the inner city as well. While every major city in the NAR is located along a major water body, in almost every instance polluted water precludes its use for swimming, and sometimes for boating as well. As a result, water must be transported from remote sources to fill the relatively small number of publicly maintained swimming pools. If convenient and inexpensive access could be provided to these rivers and estuaries, and at least part of the water area raised to acceptable standards of quality, the recreational needs of many urban residents could be more completely met, and correspondingly larger facilities could be developed.

Flood Hazards and Flood Plain Management

Despite the high risks involved in building on flood plains, flood hazards have been notoriously ignored in urban development throughout the NAR. While floods are natural phenomena that cannot be prevented, the damages arising from flooding can be reduced by two primary means: through engineering devices, and through land use controls and building regulations.

In the past considerably more emphasis has been placed on the use of engineering devices. Regulatory action to restrict urban development in areas of potential flood hazard has been weak and often ineffectual.

To guide development away from flood-prone locations, it is imperative that state planning agencies, and state and federal water resource agencies throughout the NAR, delineate areas of potential flood hazard for the guidance of local and metropolitan planning bodies. This, however, is only a first step. Engineering and regulatory measures must be implemented at the appropriate governmental level in order to achieve the following objectives: prevent existing flood problems from becoming worse; guide new development to prevent the occurrence of additional flood hazard problems; develop long-range, comprehensive plans for the balanced use of flood plains throughout individual basins.

Alternative non-physical measures for implementing include: public land acquisition of flood plain areas for use as park or other permanent open space; flood plain zoning; subdivision regulations and building design standards; and delineation of channel and floodway encroachment lines. The choice of these alternatives, and the weighing of physical against regulatory measures will depend upon specific conditions within particular basins or subbasins of the NAR.

Watersheds and Urban Use

Many cities within the NAR own extensive tracts of watershed land. The potential use of such land for selective types of urban development--new communities--for example, deserves careful study, as does the use of water resource facilities as elements to control the rate and direction of urban expansion. Water recharge areas could be used to selectively exclude or contain urban development. The acquisition of reservoir sites might also be carried out in conjunction with efforts of public development corporations to establish new communities in rural areas.

Water Management in Urban Areas

The availability of water to serve urban needs is dependent upon two primary factors--the adequacy of supplies and the efficiency of the distribution systems serving urban areas. Problems of diffused management, the absence of overall network planning, limited interconnections between competing water systems, and imbalances between population movement and system capacities probably exist within many of the metropolitan areas of the NAR. Even with assured sources of water supply, these institutional and political problems remain to be dealt with.

Outlook on the Future

Development Constraints

With a doubling of population and growing public sensitivity to environmental issues, some constraints on decision-making as it

affects land use seem inevitable. The freedom to buy, dispose and develop land will probably be modified in the direction of public interest criteria.

Applications of Technology

It is now possible to envision the future application of technology to cities in ways that enhance the possibilities of urban living. Improved building systems, particularly those that permit the construction of megastructures or super buildings, and large-scale planned unit developments, could greatly assist in the integration of urban activities with substantial gains in efficiency and environmental quality.

Variety in Life Styles

Despite rising levels of individual income, the coming two or three decades may show the first major effects of the "declining importance of goods." Emphasis is likely to shift from concern with an unlimited expansion of goods toward extending the quality and variety of services and minimizing unnecessary burdens of the daily routine.

Fifty years from now the individual is likely to demand much more of his society than was true of earlier generations. At the same time he may also want to make a greater contribution to his community, but in a way of his own choosing.

New demands for quality and for variety in life will multiply, and with it, a decreasing tolerance of poor services, particularly in the public sector. Choice, convenience, efficiency and quality are demands that will place an immense burden on planning and design, not only of the whole city, but of each of its local environments--the transportation, housing, work and recreation.

The greatest responsibility of government may be the provision of wide alternatives for choosing entirely different styles of life within each metropolis. Perhaps government will respond to the desires of special segments of the society--the religious, ethnic and special interest groups--to form their own special environments, which at once permits them to evolve in their own way and yet to participate in the larger society, giving new meaning to unity and diversity.

National Emphasis on the Man-Made and Natural Environment

Given the inevitability of an urban setting that is larger and more complex technologically, the demands made upon the city will become far more exacting. Perfecting the man-made environment may come to be regarded as among the highest objectives of national development.

Renewed concern with the man-made environment over the next fifty years will be accompanied by intensified efforts to protect, preserve and enhance the natural environment. Concepts of land or property

ownership are not likely to weaken, but ownership will less likely be associated with exploitation of the natural landscape. With rising levels of income and material well-being, a growing sense of "stewardship" of the land will be associated with its ownership.

Unique aspects of the environment--ridge tops and scenic views--as well as scarce or irreplaceable ecological communities or natural areas will increasingly be proposed for protection or preservation by conservation and consumer groups, and there is little reason to suppose that government will be unresponsive to such pressures. The importance of water bodies to the urban population of the NAR will increase enormously. Public works or utility installations which destroy, degrade or impede the functional or aesthetic potential of water bodies or shorefronts will be subject to growing public disapproval. All of these trends will pose new technical and administrative challenges for public agencies operating in the resources planning and development fields.

Widening Environmental Choice

At the same time as the attributes of suburban life are being diluted, conditions in central cities are worsening. Despite some notable examples of inner city rebuilding, physical deterioration and institutional rigidities have made the central cities of the NAR's metropolitan belt less desirable for more people. Yet the range of residential options that can be exercised by all but the very wealthiest have been narrowing. If the ghetto resident feels trapped, the feeling, at least, is not uniquely his, for the suburbanite is increasingly coming to recognize the trap into which he has become locked. Expanding the range of meaningful choice in residential environments available to all strata of the population should be a major plank in urban development policy for the NAR.

Lessons for Future Urban Development

Urbanity and Open Space

These are the two magnetic poles of urban life, arising when development is clustered or concentrated. Urbanity flourishes when intense and varied human interests and services are close at hand. The environmental benefits of urban development occur with high net densities, affording urbanity, and low gross densities, affording open space.

Efficiency in Urban Form and Transportation

Transportation efficiency improves as the urban structure is focussed at relatively few points on lines converging on a common center. Since distance is far less important in urban mass transportation than the density or distribution pattern of the people to be served, the distance between urban growth clusters can be varied according to topography or the needs for open space, without affecting the functional unity of a metropolitan area.

The efficiency of a total transportation system is based on assigning each major mode its most appropriate role. At the micro-scale, walking is by far the most efficient form of locomotion if the physical environment is designed accordingly. At the macro-scale of the metropolitan area, rail rapid transit is the most efficient means of mass travel. Like walking, its efficiency depends on planning to exploit its special characteristics. The automobile is valuable mainly for family recreation. Despite the expenditure of many billions of dollars to facilitate its use, it has serious limitations within central city areas.

Comprehensive Planning

Comprehensive planning is rapidly becoming an essential tool to manage the mass and complexity of urban growth. Since many problems are metropolitan in scope there is a growing need for linking city planning with comprehensive metropolitan and regional planning and development. Achieving such integration within a democratic and practical framework continues to pose a test of American creativity.

Alternatives - Patterns of Future Urban Growth

To facilitate the analysis of alternative development patterns, five prototypes were established as summarized below.

Alternative I-Uncontained Sprawl. Resulting from weak or ineffective land use controls; most likely to occur on the metropolitan rural-urban fringe; characterized by high ratio of small private structures and spaces, low ratio of large public open spaces; necessitates enforced travel long distances in many directions with considerable degree of isolation for non-driving members of households; low level of urbanity and relatively low level and variety of services with high costs of access.

Alternative II-Contained Sprawl. Resulting from zoning and subdivision practices now in current use; most likely to occur in older suburbs and suburbanizing areas with a relatively high degree of land saturation; characterized by many of the same conditions as sprawl but with moderate improvement in access to services; relatively large community centers or nodes for shopping, school, parks and public buildings could provide a measure of convenience and focal points for social or community activities.

Alternative III-Clustered Planned Unit Development. Based on widespread adoption of innovations in zoning that are now slowly gaining acceptance; concept would apply to a wide range of areas including the periphery of metropolitan areas or central cities, satellite cities or new towns; characterized by small private outdoor spaces, large and varied common open spaces, availability of public transportation to the most important points, increased convenience of most services and a possible degree of urbanity at the center of development; major advantage is open space preservation which could amount to more than 70 percent of the total land area.

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Alternative IV-High Rise, Superbuilding Development in Association With Clustered Planned Unit Developments. Controls would be based on major advances in the development process, including density transfer and other flexible arrangements that would necessitate considerable discretionary powers over administration; characterized by private spaces, some at walk-in locations but with public open spaces covering more than 90 percent of the area; working, shopping, recreation, education and health activities could be incorporated within or adjacent to the residential structures; urbanity and open space would be maximized.

Alternative V-Superbuildings Dominating the Inner City Structural Landscape. Dependent on major advances in the development process and in the application of urban technologies; capital requirements, scheduling and coordination would eliminate all but the largest and most efficient industrial builders; characterized by conditions much the same as Alternative IV, but with about two-thirds of the land reserved as permanent public open space; need for private automobiles in daily use would be almost totally eliminated.

A Preferred Course of Urban Development for the NAR

Urban Pattern

Two of the five alternatives--Clustered Planned Unit Development and Super Buildings in combination with Planned Unit Development--offer the maximum advantages in the planning of future urban growth within the NAR.

The most striking fact revealed by the comparative analysis is that those patterns that result in "clustering" open up immense possibilities for urban efficiency by the integration of a wide array of activities:

It concentrates development for highly efficient point-to-point transport throughout the whole metropolis.

It frees the automobile for its most natural use--family recreation.

It takes advantage of the natural efficiencies of pedestrian movement without making walking a burden.

It reduces or eliminates many sources of pollution, or provides efficient means to filter or collect effluents.

Emphasis on development clustering at the micro-scale does not require commitment to a specific shape of development at the macro-scale. The latter is infinitely more difficult to achieve and of dubious significance to most persons. By history and experience, Americans do not perceive the importance, per se, of shaping the form or delimiting the size of cities, and our institutional mechanisms in this sphere are exceedingly weak.

High net population densities yield significantly higher savings in land, increased efficiency, greater range of choice and greater mobility. Regardless of the population grouping involved, the Super Building and, to a lesser extent, the clustered row house or Planned Unit Development pattern, permits a radical saving of large and varied open spaces. Such land conservation could be achieved in central city redevelopment, peripheral, satellite and new town development, particularly if site locations are planned in relation to intersecting transportation lines or modes.

The urban geometry of high net densities simultaneously creates the conditions for the two most important physical values of the city to be achieved: (a) urbanity: the intensity and variety of services, associations and interests close at hand, and (b) open space: woods, lakes and specialized agriculture at a scale of openness that permits an entirely different environment readily accessible to the residential setting. The urban pattern of high net densities opens up the possibility of tapping to the fullest the rich potentialities of both the man-made and natural environments and placing them in a harmonious relationship.

Urban Form

While the trend of in-filling between the major metropolitan areas is expected to continue along with further suburbanization outward from the region's smaller central cities, the physical form of city and metropolitan expansion within the NAR will inevitably be varied and often conflicting. With its patterns of sprawl, the "Spread City" form of growth is expected to predominate. Simultaneously, however, federal support for and private enterprise interest in new community development could result in establishing nodes of concentrated development even within a predominant pattern of extensive land development. In the short-term, however, such development will not materially affect the urban geography of the NAR as a whole.

Inner City Rebuilding will be essential in the future. The central city and its CBD is the heart of the "urban system." Its rebuilding should be based on principles of urban efficiency and urban integration if it is to be successful.

New Towns in new locations will be essential to demonstrate the expanded possibilities of urban life through experimentation with an immense range of design possibilities. Fewer constraints exist in open areas, and building sites with poor quality for standard suburban development may prove desirable for high density new town development.

Existing suburbs will require re-orientation and rebuilding if they are not to become the slums of the future. Planning and design should be oriented so that the community may evolve toward a modest or high degree of clustering and integration over a period of decades, as the remainder of "suburbia" is amortized or reshaped.

For all of this, a stronger government role is necessary. Integration in urban activities will not be achieved without major changes in the development process. Issues of land use and its disposition are critical if metropolitan form and urban patterns are to be improved upon.

Means for Guiding Urban Growth

A population increase of 40 million with a potential 100 percent increase in developed land, the incalculable effects of rising disposable income, and unforeseeable changes in consumption patterns will all place tremendous pressures on traditional governmental procedures for controlling urban development.

In addition to the 13 states and the numerous agencies of the federal government, the NAR comprises some 272 counties, over 100 cities, and at least 1,500 incorporated towns and villages that directly or indirectly influence land and water use, and urban development planning. Separate from, but closely interrelated with the web of governmental institutions in the NAR is the private sector--the multitude of firms that own much of the land and make many of the investment decisions that determine patterns of growth and development direction.

Although current development processes give any number of private firms and public agencies some opportunity to create quality urban development, most fail to use their opportunities effectively. Fundamental improvement in the development process will not occur until public and private decision-makers attach new importance to environmental values and to the quality of urban development. Recognizing this problem, a number of national study commissions have recommended curbing local governments in the same way that local governments curb developers. Some such curbs are clearly needed, but they are likely to restrict bad local practices without effectively encouraging good ones. Major transformation of local actions appear to require structural and financial changes that are not yet on the horizon.

Regulations are often better at prohibiting poor development than in encouraging creativity and quality. This remains true even though some regulatory devices award bonuses and incentives. Nevertheless, local regulations will continue to be a fixture of the development guidance process, with federal and state measures being adopted to make local action more effective.

Going beyond regulations are such measures as land banking, public acquisition of critical development sites as at highway intersections, public assistance in land assembly, and assistance in building new towns. Current measures to assist new communities appear to be among the most encouraging steps now visible that will give developers opportunity and incentive to do a better job. Unfortunately, however, the location of new town sites is left completely to the discretion of the developer.

Administrative changes are needed in our different layers of government and in intergovernmental relations in order to achieve the following:

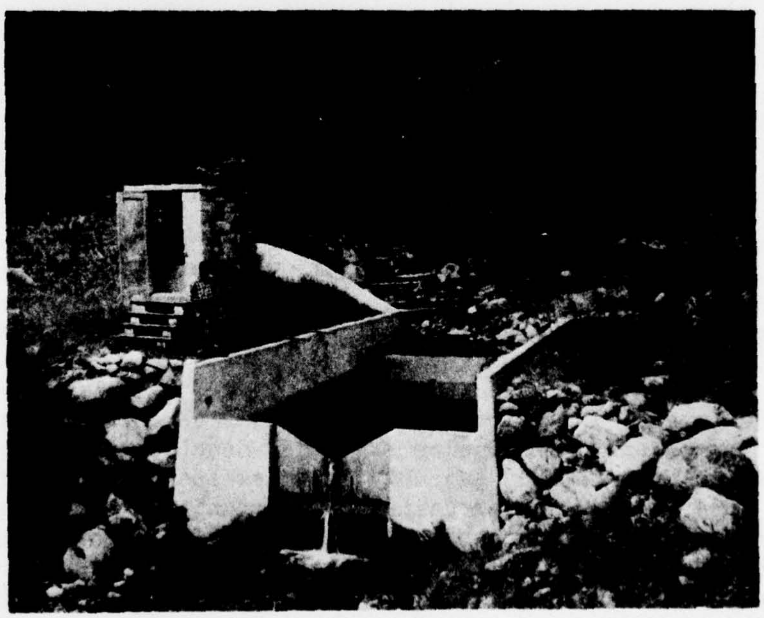
The effectiveness of public planning and policy making must be strengthened. Furthermore, the public planning function must be better related to the private sector which, in fact, builds most of the region.

Resource and land use decisions at the local level must be balanced against their metropolitan and regional consequences. Development tools, such as zoning, can no longer be exercised exclusively by local government. A mechanism for state involvement in local housing policy, for example, has been initiated in Massachusetts and may prove effective with respect to other issues related to development guidance.

The lack of program coordination among federal agencies operating in urban areas and the frequent inconsistency of federal policies concerning urban development must be reduced.

Metropolitan planning structures and processes in the NAR need additional refinement and sophistication. Such evolution will require time as well as support from the state and federal governments.

Metropolitan planning agencies must devise means for increasing their public accountability. At present, they tend to be isolated from the public as well as from the mainstream of development decision-making.



Station for continuous measurement of streamflow,
Hubbard Brook Experimental Forest, West Thornton, N.H.

NEEDED RESEARCH

Needed land use and management studies, research needs, data collection, and policy include:

Institutional Arrangements

1. Institutional considerations encompassing planning, implementation, equity, financing, sharing responsibilities, etc., present the major constraints in solving the water and related land resource problems in the Region. Large water resource problems on large hydrologic areas are difficult to handle through a multiplicity of fragmented forms of government characteristic of the Northeast. Socio-economic and political social studies to most effectively manage our resources.

2. Assesing alternative policies on land use, management and use of flood plains and shorelines, and on erosion and sedimentation control nationally and by river basin.

3. Investigations of units of government, willing to exercise their authority to enter into financial agreements and bear a large portion of the cost to satisfy widespread public demands.

Data Collection and Retrieval

4. A standardized land use classification system using one set of concepts and definitions for complete, correlated data.

5. Development of computer based methodologies for gathering and manipulating data related to water and land management studies likely to be undertaken by planning agencies, beginning with an intensive review of the information and computer programs developed in the course of the NAR Water Resources Study, evaluating their usefulness for ongoing urban planning purposes.

Watershed Protection

6. Watershed management research for improvement of water yields and maintenance of protective cover despite increased population and resource development pressures. More information about effects of vegetation on quality and quantity of water yield, streamflow extremes, and storm runoff.

7. Determination on how vegetation can improve the environmental quality especially in the megalopolis and urban - rural fringe. rural fringe. Effects of vegetative changes on visual quality of landscape patterns and on ecological systems.

8. Effective procedures to implement erosion control plans and practices. Efficient and feasible erosion control practices for use in urban and suburban developments that are compatible with efficient construction practices.

Waste Disposal and Land Management

9. Recycling of solid waste material to alleviate the amount of land needed for sanitary landfill. Manufacturer's "disposal" tax, banning nonreturnable containers, self-destructing materials, improved collection and reprocessing techniques, and forced recycling are a few of the alternative methods.

10. Practical land uses and treatment for the reclamation of completed sanitary landfills and strip mined areas.

11. The use of crop and pasture land for the regulated incorporation of sewage sludge to benefit crop production as an alternative to the ocean for dumping. Efficient ways to transport and use sewage effluent for agricultural and nonagricultural uses.

12. Testing of prototype urban development patterns that simulate "sprawl", "clustering", and "concentration", at varying densities and mixes, to evaluate their impact on selected aspects of the natural environment.

13. Analysis of water management problems resulting from locational shifts in population and economic activity from the central city to the metropolitan periphery; formulation of strategies and programs to deal with imbalances between dispersed patterns of "water users" and concentrated patterns of metropolitan water supply infrastructure and delivery capacity.

Flood Hazards

14. Classification of flood hazard zones typically occurring in the river basins of the NAR and along its coastal margins, and the preparation of guidelines regarding the type, extent and intensity of development that should be permitted.

15. Selected basin or subbasin case studies to define and delineate flood hazard zones existing within areas that are now urbanized or which lie in the path of impending urban growth, and to evaluate (a) the applicability, and (b) the potential effectiveness of alternative regulatory measures to alleviate existing or potentially hazardous conditions.

Potentials of Water and Related Land Resources in Urban Development and Redevelopment

16. Inventory and analysis of the substantial areas of municipally owned watershed lands within the NAR; evaluation of their long-term usefulness for water supply, and their potential suitability for diversified or multipurpose urban use as, for example, New Community sites or seasonal recreational facilities for residents of the respective owning municipalities.

17. Classification and evaluation of development and redevelopment opportunities existing along the waterfronts of the major metropolitan cities of the NAR for future residential and open space use.

18. Study and assessment of differences in level of water supply and water quality available to residents of urban areas based on location - inner city and core, inner ring suburbs, outer ring suburbs, rural-urban fringe.

Urban Planning Agency Involvement in Resources Management

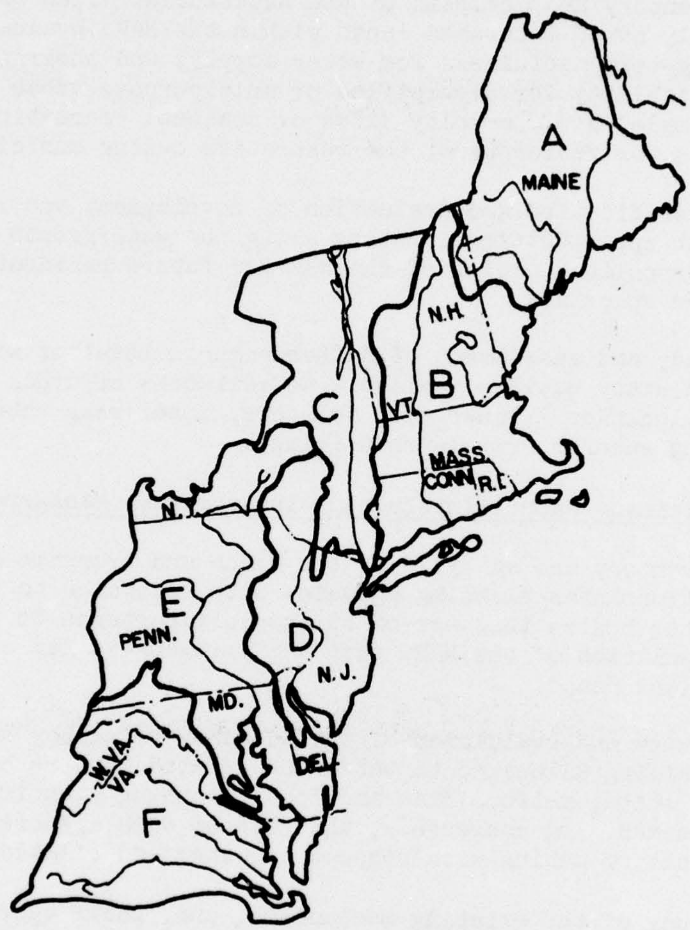
19. Inventory and analysis of the plans and programs of city and metropolitan planning agencies with reference to specific water bodies that are of strategic importance to the urban population of the NAR, such as Narragansett Bay or Long Island Sound.

20. Review and evaluation of the adequacy of agency budgets and staffing allocated to water and related land resource studies by state, metropolitan and local planning agencies within the NAR, and conversely, the role of such agencies in decision-making with respect to water and related land use.

21. Study of the existing mechanisms, and, where appropriate, recommendations for improving coordination between state and federal water resource agencies on the one hand, and metropolitan and local urban planning agencies on the other.

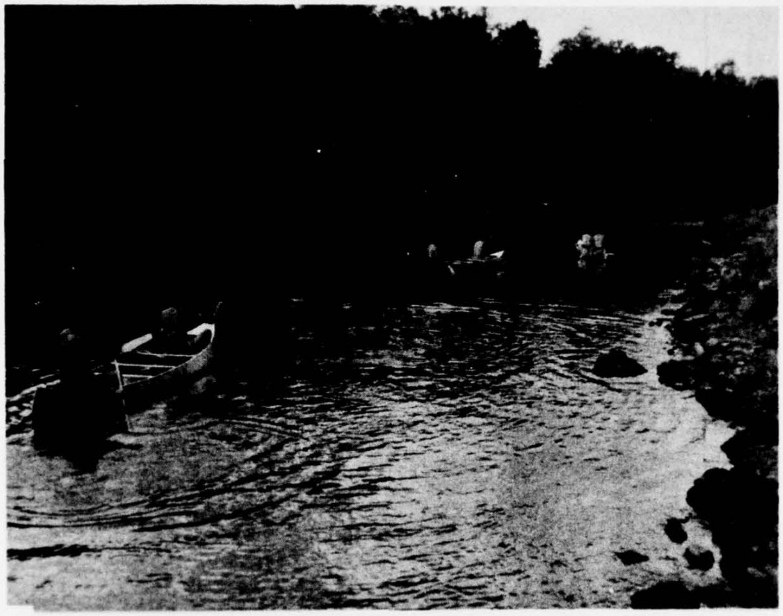
22. Analysis of projected water resource projects within specific basins or subbasins to determine where urban planning and development agencies and water resource agencies might have complementary planning, regulatory or programmatic interests as, for example, the feasibility of acquiring land for a new town site at the same time as, and in conjunction with, land acquisition for a reservoir site.

IV SUBREGIONAL SUMMARIES



LAND USE BY SUBREGION
NORTH ATLANTIC REGION

Subregion	Crop Land	Pasture	Forest	Other Land	Urban	Water	Total
			Acres				
A	1,070	177	16,805	291	437	1,339	20,119
B	1,318	650	13,387	1,140	1,440	961	18,896
C	2,581	1,628	9,990	1,217	1,070	901	17,387
D	2,252	525	5,396	1,222	1,451	375	11,221
E	5,785	1,683	11,519	1,959	1,111	763	22,820
F	3,041	2,039	12,646	1,071	835	381	20,013
TOTAL	16,047	6,702	69,743	6,900	6,344	4,720	110,456



Clean water makes good canoeing for Boy Scouts.

Clear unpolluted stream produces golden trout for anglers.

TABLE G-84

LAND TREATMENT - SUBREGION A
NATIONAL EFFICIENCY OBJECTIVE
NORTH ATLANTIC REGION

Land Use By Dominant Problems	Present: Total Land	Present: Requiring Treatment	Suggested Treatment, Time Frame Year: 1980	Suggested Treatment, Time Frame Year: 2000	Suggested Treatment, Time Frame Year: 2020	Suggested Treatment: Total	Treatment Cost for 1980 1/: Installation	Treatment Cost for 1980 1/: Tech. Asst.	Treatment Cost for 1980 1/: One Time
	Thousand Acres						Dollars Per Acre		$ Million
Cropland									
Erosion	373	302	79	50	7	136	44	10	4.3
Excess Water	312	181	19	46	80	145	29	10	.7
Unfavorable Soil Conditions	369	177	42	26	6	74	2	10	.5
Few Limitations	16	-							
Subtotal	1070	660	140	122	93	355			5.5
Pasture									
Erosion	39	30							
Excess Water	68	50	15	7	1	23	35	10	.7
Unfavorable Soil Conditions	68	50	15	7	1	23	119	10	1.9
Few Limitations	2	-							
Subtotal	177	130	30	14	2	46			2.6
Forest									
Management 2/	-	10014	1120	2100	2100	5320	19	8	30.2
Protection 2/	-	(10009)3/	(1090)	(2040)	(2040)	(5170)	1	2	3.3
Erosion	693	(1)	-	-	(1)	(1)			
Excess Water	2566	(1213)	-	(60)	(180)	(240)			
Unfavorable Soil Conditions	13532								
Few Limitations	14	-							
Subtotal	16805	10014	1120	2100	2100	5320			33.5
Other									
Erosion	28	2							
Excess Water	164	16	46	55	82	183	116	10	5.8
Unfavorable Soil Conditions	41	4	21	27	33	81	32	10	.9
Few Limitations	58	-							
Subtotal	291	22	67	82	115	264			6.7
Urban									
Subtotal	437	-	2	8	6	16	120	10	.3
TOTAL	18780	10826	1359	2326	2316	6001			48.6

1/ Price base 1970.
2/ Protection and management requirements are needed for all dominant problems.
3/ Figures in parentheses are not included in totals.

SUBREGION A (Areas 1,2,3,4 and 5)

Present and Projected Land Use

The present percent of each land use within the subregion, the amount of land that has been adequately treated with conservation practices, and the projected uses and treatments for the various objectives by time frames are illustrated in Figure G-11.

Cropland

There are 1,070,000 acres of cropland in the subregion. This represents nearly 6 percent of the total land area. The dominant crops, corn for silage and grain and hay crops grown in rotation, support dairy farming. Specialized crops produced are potatoes, sugarbeets and blueberries.

Cropland is expected to decline to about 1 percent by 2020. This represents a decrease to 178,000 acres by 2020. The subregion will experience an increase in forest and Other land.

Pasture

There are 177,000 acres of pasture representing about 1 percent of the total land area. Pastures are on the steeper sloping hillsides on stony shallow soils and are used to support dairy farming.

Pasture is expected to nearly discontinue as a land use. Only 20,000 acres are expected to remain in pasture by 2020. Livestock numbers will diminish also as cropland and pasture decline in acreage.

Forest

Forest land in this subregion, the most densely forested of the NAR, amounts to about 16.8 million acres - 89 percent of the land area. The subregion contains a quarter of the total growing stock and half of the softwood growing stock of the Region. Average annual production of pulpwood is 2.1 million cords, while sawlogs, veneer logs and miscellaneous products account for an additional 46.4 million cubic feet. The value added by manufacturing in wood product industries comprises 36 percent of the value added by all industries. About 99 percent of the commercial forest land is in private ownership, and of this, industries own 41 percent. (Tables G-45-55) Important public ownerships include the White Mountain National Forest, Acadia National Park, Baxter State Park, and Moosehorn National Wildlife Refuge. The Allagash is the first State Wilderness Waterway to be included in the National Wild and Scenic Rivers System; the Penobscot is scheduled for study in 1972. The largest tree farm (over 1.4 million acres) within a single state in the nation is located here. It has been under continuous forest management since 1903. Forest area is projected to vary little through 2020.

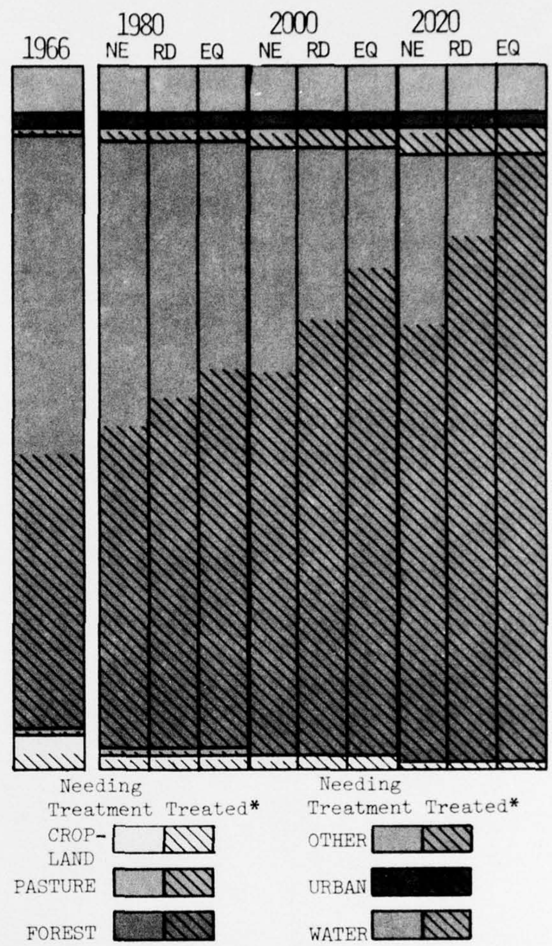


FIGURE G-11

Other

There are 291,000 acres of Other land representing about 1 percent of the total land area. There are 127,000 acres of Other land in farms and 164,000 acres classified as nonfarm.

Other land is expected to increase to nearly 9 percent by 2020. There will be 1,682,000 acres by 2020. Expected use of Other land includes rural nonfarm population, recreation and wildlife cover.

Urban

There are 437,000 acres of urban land representing about 2 percent of the total land area. Urban areas are comprised of smaller cities and towns.

Urban land is expected to increase slightly and will represent 462,000 acres by 2020.

* Includes land adequately treated or not necessary to treat. R8/71

TABLE G-85

LAND TREATMENT - SUBREGION B
NATIONAL EFFICIENCY OBJECTIVE
NORTH ATLANTIC REGION

Land Use By Dominant Problems	Present: Total Land	Present: Requiring Treatment	Suggested Treatment, Time Frame Year: 1980	2000	2020	Total	Treatment Cost for 1980 1/: Instal-lation	Tech. Asst.	One Time
			Thousand Acres				Dollars Per Acre		$ Million
Cropland									
Erosion	557	340	92	46	8	146	18	18	3.3
Excess Water	342	156	28	70	27	125	78	18	2.7
Unfavorable Soil Conditions	305	174	59	29	5	93	12	18	1.8
Few Limitations	114	-							
Subtotal	1318	670	179	145	40	364			7.8
Pasture									
Erosion	170	129							
Excess Water	137	104	34	17	2	53	67	18	2.9
Unfavorable Soil Conditions	327	249	31	37	4	122	259	18	22.4
Few Limitations	16	-							
Subtotal	650	482	115	54	6	175			25.3
Forest									
Management 2/		10881	1980	2840	2680	7500	22	10	63.4
Protection 2/		(10873)3/	(1180)	(2240)	(2220)	(5640)	1	4	5.9
Erosion	680	(8)	(1)	(3)	(4)	(8)	40	15	.1
Excess Water	1459	(669)	-	(13)	(37)	(50)			
Unfavorable Soil Conditions	11156	-							
Few Limitations	92	-							
Subtotal	13387	10881	1980	2840	2680	7500			69.3
Other									
Erosion	224	98							
Excess Water	359	155	75	88	99	262	156	18	13.1
Unfavorable Soil Conditions	429	188	151	165	216	532	53	18	10.7
Few Limitations	128	-							
Subtotal	1140	441	226	253	315	794			23.8
Urban									
Subtotal	1440	-	272	580	897	1749	120	18	37.5
TOTAL	17935	12474	2772	3872	3938	10582			163.7

1/ Price base 1970.
2/ Protection and management requirements are needed for all dominant problems.
3/ Figures in parentheses are not included in totals.

SUBREGION B (Areas 6,7,8,9 and 10)

Present and Projected Land Use

The present percent of each land use within the subregion, the amount of land that has been adequately treated with conservation practices, and the projected uses and treatments for the various objectives by time frames are illustrated in Figure G-12.

Cropland

There are 1,318,000 acres of cropland in the subregion. This represents nearly 7 percent of the total land area. The dominant crops, corn for silage and grain and hay crops grown in rotation support dairy farming. Specialized crops produced are cranberries, vegetables and tobacco.

Cropland is expected to decline to about 1 percent by 2020. This represents a decrease to 173,000 acres by 2020. The subregion will experience a substantial decrease in cropland owing to urban and industrial encroachment.

Pasture

There are 650,000 acres of pasture representing about 4 percent of the total land area. Pastures are on the steeper sloping hillsides on stony shallow soils and are used to support dairy farming.

A decline of pasture to about 1 percent of the land area is expected by 2020. This represents a decrease to 86,000 acres. Livestock numbers are expected to diminish as cropland and pasture decline in acreage.

Forest

This is the second most heavily forested subregion in the NAR with 13.4 million acres of forest land, 75 percent of its total land area. Average annual production of pulpwood is about 400,000 cords, while sawlogs, veneer logs and miscellaneous products account for an additional 65 million cubic feet. The economic contribution of wood product industries, while overshadowed by the large metropolitan and industrial complexes, is important to many rural communities. About 90 percent of the forest land is in private ownership. (Tables G-45 - G-55) About 900,000 acres of the White Mountains, and 629,000 acres of the Green Mountain National Forests are within the subregion. These Forests provide all or part of the water supplies of 30 towns and cities, yield high quality water for downstream use, raw materials for local wood-using industries, recreational opportunities, wildlife habitat, and return 25 percent of their gross receipts to the counties in which they are located. By 2020 commercial forest area is projected to decrease by about 15 percent, with greatest losses around the metropolitan areas.

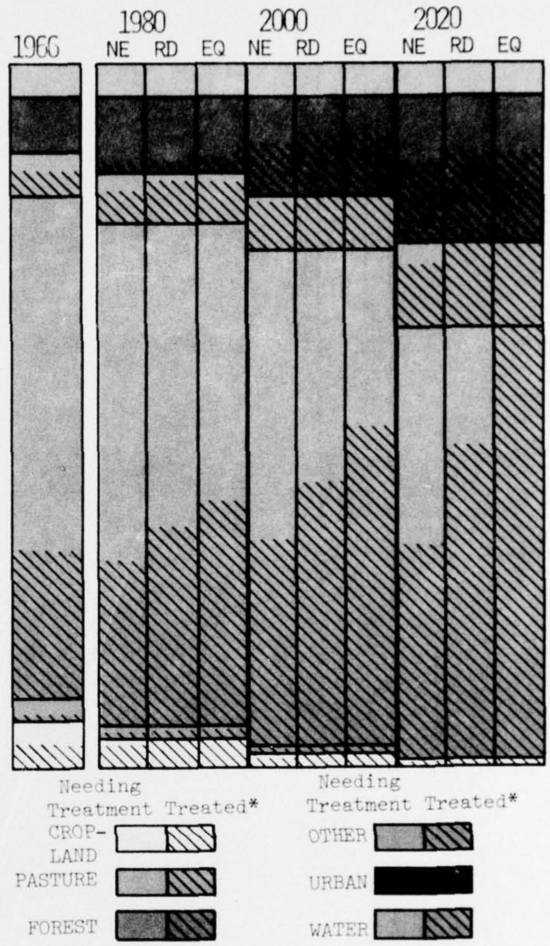


FIGURE G-12

Other

There are 1,140,000 acres of Other land representing about 6 percent of the total land area. There are nearly 196,000 acres in farms and 944,000 acres classified as non farm.

Other land is expected to increase to nearly 8 percent by 2020. There will be 1,413,000 acres by 2020. Expected use of Other land includes rural nonfarm population, recreation and construction of roads.

Urban

There are 1,440,000 acres of urban land representing about 8 percent of the total land area. 80 percent of the population lives in urban areas. Many of the large metropolitan centers are located along the coastal areas in the subregion. A significant increase in urban land is expected. Nearly 22 percent representing 3,967,000 acres will be in urban land by 2020.

* Includes land adequately treated or not necessary to treat.

TABLE G-86

LAND TREATMENT - SUBREGION C
NATIONAL EFFICIENCY OBJECTIVE
NORTH ATLANTIC REGION

Land Use By Dominant Problems	Present: Total Land	Present: Requiring Treatment	Suggested Treatment: Time Frame Year 1980	2000	2020	Total	Treatment Cost for 1980 1/: Instal-lation	Tech. Asst.	One Time
			Thousand Acres				Dollars Per Acre		$ Million
Cropland									
Erosion	1359	704	262	182	50	494	18	12	7.9
Excess Water	839	411	62	163	103	328	47	12	3.7
Unfavorable Soil Conditions	241	120	45	32	9	86	6	12	.8
Few Limitations	142	-							12.4
Subtotal	2581	1235	369	377	162	908			
Pasture									
Erosion	580	400							
Excess Water	436	301	110	76	14	200	50	12	6.8
Unfavorable Soil Conditions	591	408	150	103	19	272	163	12	26.2
Few Limitations	21	-							
Subtotal	1628	1109	260	179	33	472			33.0
Forest									
Management 2/		8335	1230	1980	2090	5300	6	4	12.3
Protection 2/		(8284) 3/	(1070)	(1840)	(1840)	(4750)	1	2	3.2
Erosion	1757	(13)	(3)	(5)	(5)	(13)	40	10	.1
Excess Water	1154	(794)	-	(26)	(77)	(103)			
Unfavorable Soil Conditions	7009	-							
Few Limitations	70	-							
Subtotal	9990	8335	1230	1980	2090	5300			15.5
Other									
Erosion	395	139							
Excess Water	372	146	59	58	78	195	109	12	7.1
Unfavorable Soil Conditions	396	167	90	89	82	261	18	12	2.7
Few Limitations	54	-							
Subtotal	1217	452	149	147	160	456			9.8
Urban									
Subtotal	1070	-	58	169	143	370	120	12	7.7
TOTAL	16486	11131	2066	2852	2588	7506			78.4

1/ Price base 1970.
2/ Protection and management requirements are needed for all dominant problems.
3/ Figures in parentheses are not included in totals.

SUBREGION C (Areas 11,12 and 13)

Present and Projected Land Use

The present percent of each land use within the subregion, the amount of land that has been adequately treated with conservation practices and the projected uses and treatments for the various objectives by time frames are illustrated in Figure G-13.

Cropland

There are 2,581,000 acres of cropland in the subregion. This represents nearly 16 percent of the total land area. The dominant crops, corn for silage and grain and hay crops grown in rotation, support dairy farming. Specialized crops produced are fruits such as apples and peaches, vegetables and potatoes.

Cropland is expected to decline to 5.4 percent by 2020. This represents a decrease to 885,000 acres by 2020. The subregion will experience a substantial decrease in cropland owing to urban and industrial encroachment.

Pasture

There are 1,628,000 acres of pasture representing about 10 percent of the total land area. Pastures are on the sloping hillsides on stony shallow soils and are used to support dairy farming.

A decline of pasture to about 3 percent of the land area is expected by 2020. This represents a decrease to 527,000 acres by 2020. Livestock numbers will diminish as cropland and pasture decline in acreage.

Forest

This subregion is about 60 percent forested. Hardwoods comprise 80 percent of the forest stands. The subregion ranks second in the Region in average annual production of sawlogs, veneer logs and miscellaneous timber products, with 80 million cubic feet, or 20 percent of regional production. In addition, over 340,000 cords of pulpwood are harvested annually. About 94 percent of commercial forest land is in private ownership. Of publicly owned commercial forest land, 66 percent is state, county and municipal, 31 percent in the Green Mountain National Forest, and 3 percent other federal. (Tables G-45-G-55) Not included in the commercial area is one of the most widely known forest areas in the Region, the Adirondack State Forest Preserve of more than 2.5 million acres. Most of the 230,000 acre Catskill Forest Preserve is also in this subregion, providing valuable watersheds for some of the major reservoirs supplying water to New York City. As of 1965 about 166,000 acres had also been purchased for state forests. Total forest area is projected to increase.

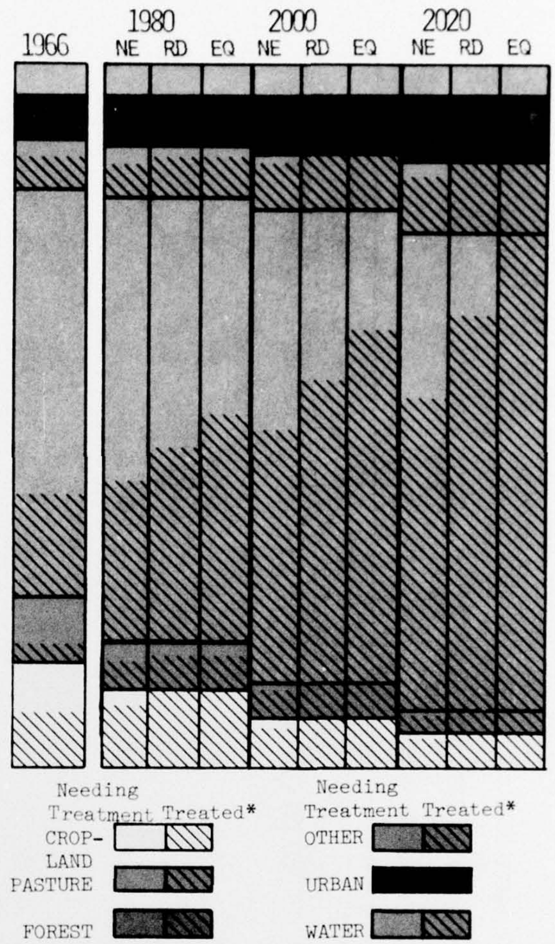


FIGURE G-13

Other

There are 1,217,000 acres of Other land representing about 7 percent of the total land area. There are nearly 300,000 acres in farms and over 900,000 acres classified as nonfarm.

A significant increase in Other land is expected by 2020 Nearly 16 percent representing over 2,600,000 acres will be in Other land. The growth in rural nonfarm population and the construction of roads are the major users of Other land.

Urban

There are 1,070,000 acres of urban land representing about 6 percent of the total land area. The densely populated centers are located in the lower part of the subregion and include New York City and surrounding areas. The coastal areas are a part of the large urban complex along the eastern seaboard.

Urban land is expected to increase to about 10 percent of the land area by 2020. This represents an increase to about 1,604,000 acres.

* Includes land adequately treated or not necessary to treat.

TABLE G-87

LAND TREATMENT - SUBREGION D
NATIONAL EFFICIENCY OBJECTIVE
NORTH ATLANTIC REGION

Land Use By Dominant Problems	Present: Total Land	Present: Requiring Treatment	Suggested Treatment, Time Frame Years: 1980	2000	2020	Total	Treatment Cost for 1980 1/: Instal-lation	Tech. Asst.	One Time
			Thousand Acres				Dollars Per Acre		$ Million
Cropland									
Erosion	1416	841	307	207	49	563	29	13	12.9
Excess Water	438	239	44	116	31	191	70	13	3.7
Unfavorable Soil Conditions	264	158	46	37	10	93	11	13	1.1
Few Limitations	134	-							
Subtotal	2252	1238	397	360	90	847			17.7
Pasture									
Erosion	254	122							
Excess Water	160	78	31	20	5	56	71	13	2.6
Unfavorable Soil Conditions	102	50	20	14	4	38	112	13	2.5
Few Limitations	9	-							
Subtotal	525	250	51	34	9	94			5.1
Forest									
Management 2/		4803	650	1080	1040	2770	18	10	18.2
Protection 2/		(4799)3/	(540)	(990)	(980)	(2510)	1	2	1.6
Erosion	1009	(8)	(2)	(3)	(3)	(8)	40	11	.1
Excess Water	1063	(752)	-	(14)	(44)	(58)			
Unfavorable Soil Conditions	3242	-							
Few Limitations	82	-							
Subtotal	5396	4803	650	1080	1040	2770			19.8
Other									
Erosion	389	107							
Excess Water	567	149	196	247	129	572	178	13	37.4
Unfavorable Soil Conditions	163	44	64	82	44	190	22	13	2.2
Few Limitations	103	-							
Subtotal	1222	300	260	329	173	762			39.6
Urban									
Subtotal	1451	-	170	480	554	1204	120	13	22.6
TOTAL	10846	6591	1528	2283	1866	5677			104.8

1/ Price base 1970.
2/ Protection and management requirements are needed for all dominant problems.
3/ Figures in parentheses are not included in totals.

SUBREGION D (Areas 14,15 and 16)

Present and Projected Land Use

The present percent of each land use within the subregion, the amount of land that has been adequately treated with conservation practices, and the projected uses and treatments for the various objectives by time frames are illustrated in Figure G-14.

Cropland

There are 2,252,000 acres of cropland in the subregion. This represents nearly 21 percent of the total land area. The dominant crops, corn for grain or silage and hay crops grown in rotation support dairy farming. Specialized crops produced are vegetables, potatoes, fruits and berries.

Cropland is expected to decline to about 5 percent by 2020. Urban and industrial pressures will cause a decline in cropland.

Pasture

There are 525,000 acres of pasture representing nearly 5 percent of the total land area. Pastures are on the steeper sloping hillsides on stony shallow soils and are used to support dairy farming.

A decline of pasture to about 2 percent of the land area is expected by 2020. This represents a decrease to 171,000 acres by 2020. Livestock numbers will diminish as cropland and pasture decline in acreage.

Forest

This is the least forested subregion, with about 5.4 million acres of forest, half of its total land area. Hardwoods constitute over 80 percent of forest stands. Production of sawlogs, veneer logs and miscellaneous products amounts to 34 million cubic feet, 9 percent of NAR production. About 89 percent of the forest area is privately owned. State, county and municipal make up 97 percent of the public ownership. (Tables G-45 -G-55) About 50,000 acres of the Catskill Forest Preserve provide valuable watershed for municipal and industrial supply. New York also contains about 13,700 acres of state forest and recreation land, and New Jersey 273,000 acres of state, county and municipal forest land. The Upper Delaware River is under study for proposed inclusion in the National Wild and Scenic Rivers System. Total forest land is projected to decrease about 10 percent by 2020.

Other

There are 1,222,000 acres of Other land representing about 11 percent of the land area. There are nearly 249,000 acres in farms and 965,000 acres classified as nonfarm. Other land that is idle and open is used primarily for wildlife cover and recreation.

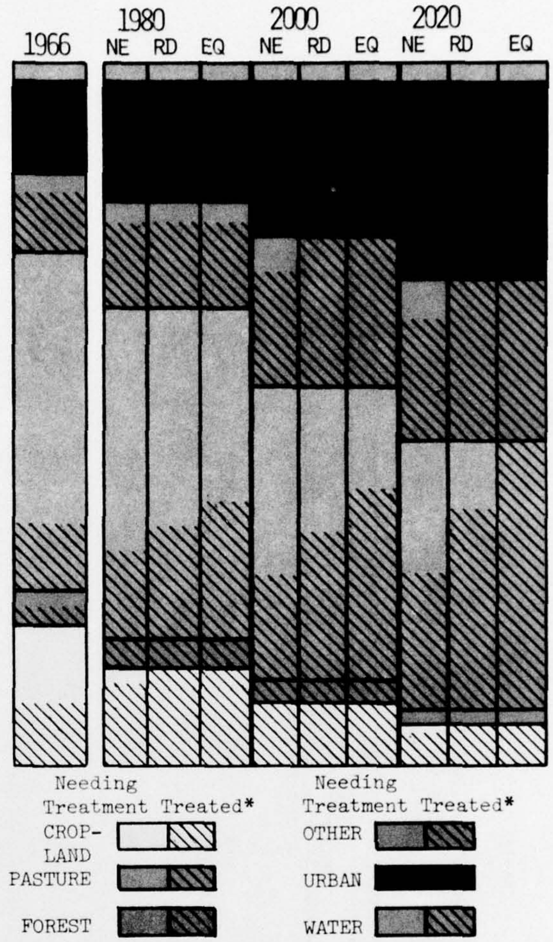


FIGURE G-14

Other land is expected to increase significantly by 2020. Nearly 24 percent representing 2,603,000 acres will be in Other land by 2020. Expected use of Other land includes rural nonfarm population, recreation and the construction of roads.

Urban

There are 1,450,000 acres of urban land representing more than 13 percent of the total land area. The subregion is densely populated and is part of the large urban complex along the eastern seaboard.

Urban land is expected to increase to about 29 percent of the land area by 2020. Approximately 3,170,000 acres will be in urban land.

* Includes land adequately treated or not necessary to treat.

TABLE G-88

LAND TREATMENT - SUBREGION E
NATIONAL EFFICIENCY OBJECTIVE
NORTH ATLANTIC REGION

Land Use By Dominant Problems	Present		Suggested Treatment				Treatment Cost for 1980 1/		
	Total Land	Requiring Treatment	Time Frame Years 1980	2000	2020	Total	Instal-lation	Tech. Asst.	One Time
	Thousand Acres						Dollars Per Acre		$ Million
Cropland									
Erosion	3938	2652	1078	841	102	2021	36	8	47.4
Excess Water	1162	532	159	266	-	425	55	8	10.0
Unfavorable Soil Conditions	291	185	73	57	14	144	16	8	1.8
Few Limitations	394	-							
Subtotal	5785	3369	1310	1164	116	2590			59.2
Pasture									
Erosion	1054	625							
Excess Water	419	249	112	85	21	218	66	8	8.3
Unfavorable Soil Conditions	177	105	48	36	9	93	124	8	6.3
Few Limitations	33	-							
Subtotal	1683	979	160	121	30	311			14.6
Forest									
Management 2/		8927	1340	2170	2160	5670	16	8	32.2
Protection 2/		(8921) 3/	(980)	(1860)	(1860)	(4700)	1	2	2.9
Erosion	4515	(35)	(7)	(14)	(14)	(35)	40	7	.3
Excess Water	1615	(1365)	-	(19)	(57)	(76)			
Unfavorable Soil Conditions	5225	-							
Few Limitations	164	-							
Subtotal	11519	8927	1310	2170	2160	5670			35.1
Other									
Erosion	975	313							
Excess Water	724	223	24	-	13	37	160	8	4.0
Unfavorable Soil Conditions	156	49	13	-	7	20	19	8	.4
Few Limitations	104	-							
Subtotal	1959	585	37	-	20	57			4.4
Urban									
Subtotal	1111	-	204	586	974	1764	120	8	26.1
TOTAL	22057	13860	3051	4041	3300	10392			139.4

1/ Price base 1970.
2/ Protection and management requirements are needed for all dominant problems.
3/ Figures in parentheses are not included in totals.

SUBREGION E (Areas 17 and 18)

Present and Projected Land Use

The present percent of each land use within the subregion, the amount of land that has been adequately treated with conservation practices, and the projected uses and treatments for the various objectives by time frames are illustrated in Figure G-15.

Cropland

There are 5,785,000 acres of cropland in the subregion. This represents nearly 26 percent of the total land area. The dominant crops are corn for grain and silage, wheat and hay crops. Specialized crops are potatoes, vegetables and tobacco.

Cropland is expected to decline to about 13 percent by 2020. This represents a decrease to 2,799,000 acres by 2020. This subregion will experience a decrease in cropland owing to urban and industrial encroachment.

Pasture

There are 1,683,000 acres of pasture representing nearly 8 percent of tne total land area. Pastures are on the steeper hillsides on shallow soils and are used to support dairy farming.

A decline of pasture to about 4 percent of the land area is expected by 2020. This represents a decrease to 837,000 acres by 2020. Livestock numbers will diminish also as cropland and pastures decline in acreage.

Forest

The area of forest land is about 11.5 million acres, 52 percent of the land area. Hardwoods comprise about 90 percent of the forest stands. The subregion supplies 10 percent (510,000 cords) of the NAR average annual production of pulpwood, and 15 percent (58 million cubic feet) of the sawlogs, veneer logs and miscellaneous products. The contribution made by wood product industries is important to many rural communities. About 79 percent of the commercial forest land is privately owned. Federal ownership is negligible. (Tables G-45-G-55) In New York are 163,000 acres of State Forest Land and 5,500 acres of State recreation land; Pennsylvania has 2.1 million acres in State Forests, parks and game land; Maryland has 41,000 acres of State, county and municipal forest land. Total forest area is projected to increase by more than 10 percent by 2020.

Other

There are 1,959,000 acres of Other land representing about 9 percent of the total land area. There are nearly 550,000 acres in farms and 1,409,000 acres classified as nonfarm.

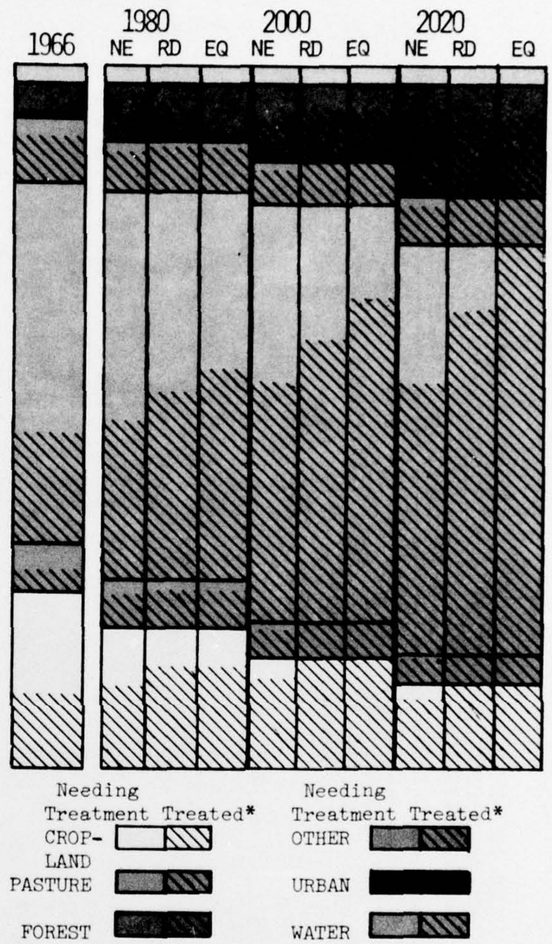


FIGURE G-15

Other land is expected to decline to 7 percent by 2020. Expected use of Other land includes recreation, rural nonfarm population and for construction of major roads.

Urban

There are 1,111,000 acres of urban land representing about 5 percent of the total land area. Many large metropolitan centers are located in the subregion and are a part of the large urban complex found along the eastern seaboard.

A significant increase in urban land is expected. Nearly 17 percent representing 3,686,000 acres will be in urban land by 2020.

* Includes land adequately treated or not necessary to treat.

TABLE G-89

LAND TREATMENT - SUBREGION F
NATIONAL EFFICIENCY OBJECTIVE
NORTH ATLANTIC REGION

Land Use By Dominant Problems	Present: Total Land	Present: Requiring Treatment	Suggested Treatment: Time Frame Year 1980	2000	2020	Total	Treatment Cost for 1980 1/: Instal-lation	Tech. Asst.	One Time
			Thousand Acres				Dollars Per Acre		$ Million
Cropland									
Erosion	2124	1391	639	486	118	1243	32	12	28.1
Excess Water	468	301	61	100	-	161	79	12	5.6
Unfavorable Soil Conditions	287	145	58	44	16	118	12	12	1.4
Few Limitations	162	-							
Subtotal	3041	1737	758	630	134	1522			35.1
Pasture									
Erosion	1414	725							
Excess Water	277	142	73	52	15	140	84	12	7.0
Unfavorable Soil Conditions	316	162	83	60	17	160	116	12	10.6
Few Limitations	32	-							
Subtotal	2039	1029	156	112	32	300			17.6
Forest									
Management 2/		10023	1420	2340	2300	6060	11	8	27.0
Protection 2/		(9998)3/	(1300)	(2240)	(2230)	(5770)	4	1	6.5
Erosion	7609	(89)	(19)	(35)	(35)	(89)	70	10	1.5
Excess Water	1801	(1268)	-	(36)	(107)	(143)			
Unfavorable Soil Conditions	3116	-							
Few Limitations	120	-							
Subtotal	12646	10023	1420	2340	2300	6060			33.5
Other									
Erosion	609	342							
Excess Water	290	171	65	137	100	302	114	12	8.2
Unfavorable Soil Conditions	142	82	15	64	48	127	53	12	1.0
Few Limitations	30	-							
Subtotal	1071	595	80	201	148	429			9.2
Urban									
Subtotal	835	-	118	343	546	1007	120	12	15.6
TOTAL	19632	13384	2532	3626	3160	9318			111.0

1/ Price base 1970.
2/ Protection and management requirements are needed for all dominant problems.
3/ Figures in parentheses are not included in totals.

SUBREGION F (Areas 19,20 and 21)

Present and Projected Land Use

The present percent of each land use within the subregion, the amount of land that has has been adequately treated with conservation practices, and the projected uses and treatments for the various objectives by time frames are illustrated in Figure G-16.

Cropland

There are 3,041,000 acres of cropland in the subregion. This represents over 15 percent of the total land area. The dominant crops are corn for grain and silage, and wheat and hay crops grown in rotation. Specialized crops include tobacco, fruits and nuts.

Cropland is expected to decline to about to eight percent by 2020. This represents a decrease to 1,585,000 acres by 2020. The decline in cropland is the result of an increase in Other and urban land uses.

Pasture

There are 2,039,000 acres of pasture representing about 10 percent of the total land area. Pastures are on the steeper hillsides or on areas that are poorly drained.

A decline of pasture to about 5 percent of the land is expected by 2020. Livestock numbers will diminish also as cropland and pastures decline in acreage.

Forest

The subregion contains about 12.5 million acres of forest land, 65 percent of its land area. Hardwoods constitute 75 percent of the forest stands. The subregion ranks first (107 million cubic feet) in the production of sawlogs, veneer logs and miscellaneous timber products, and second in the production of pulpwood (1.4 million cords) in NAR. The contribution of wood products industries is important to many rural areas.

About 86 percent of commerical forest area is privately owned. Of publicly owned areas, 62 percent is in the Monongahela, George Washington, and Jefferson National Forests, 37 percent in state, county or municipal, and 1 percent in other federal ownership. (Tables G-45-G-55) The National Forests are managed under the principles of multiple use and substained yield for the production of water, recreation, wildlife, wood products, and forage. Total forest acreage is projected to vary little through 2020.

Other

There are 1,071,000 acres of Other land representing about 6 percent of the total land area. There are nearly 310,000 acres of Other land in farms and over 760,000 acres classified as nonfarm.

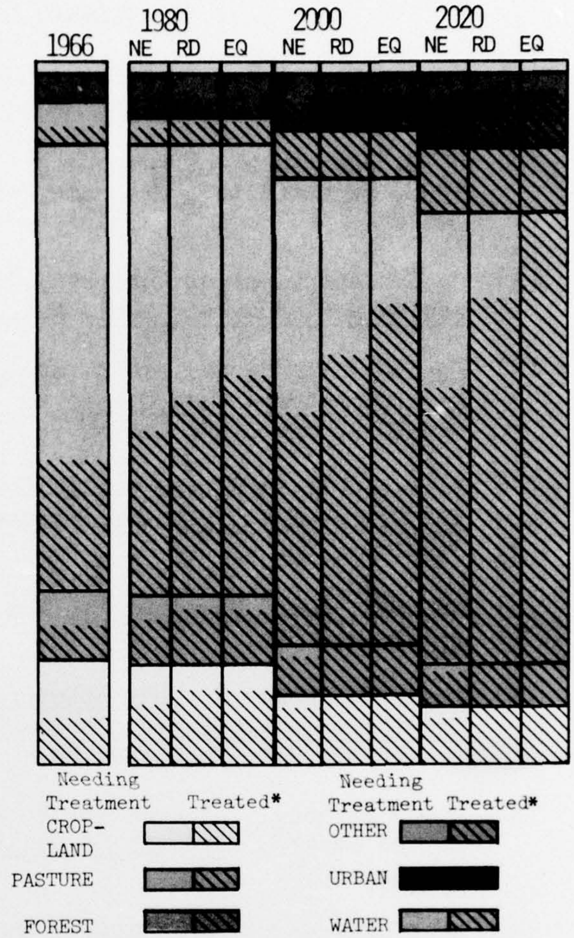


FIGURE G-16

Other land is expected to increase to 12 percent of the total land area by 2020. This represents an increase to 2,380,000 acres by 2020. Expected use of Other land includes recreation, rural nonfarm population and wildlife cover.

Urban

There are 835,000 acres of urban land representing nearly 4 percent of the total land area. The major population centers along the coastal areas are a part of the urban complex along the eastern seaboard.

A significant increase in urban land is expected by 2020. Nearly 11 percent representing 1,513,000 acres will be in urban land.

* Includes land adequately treated or not necessary to treat.

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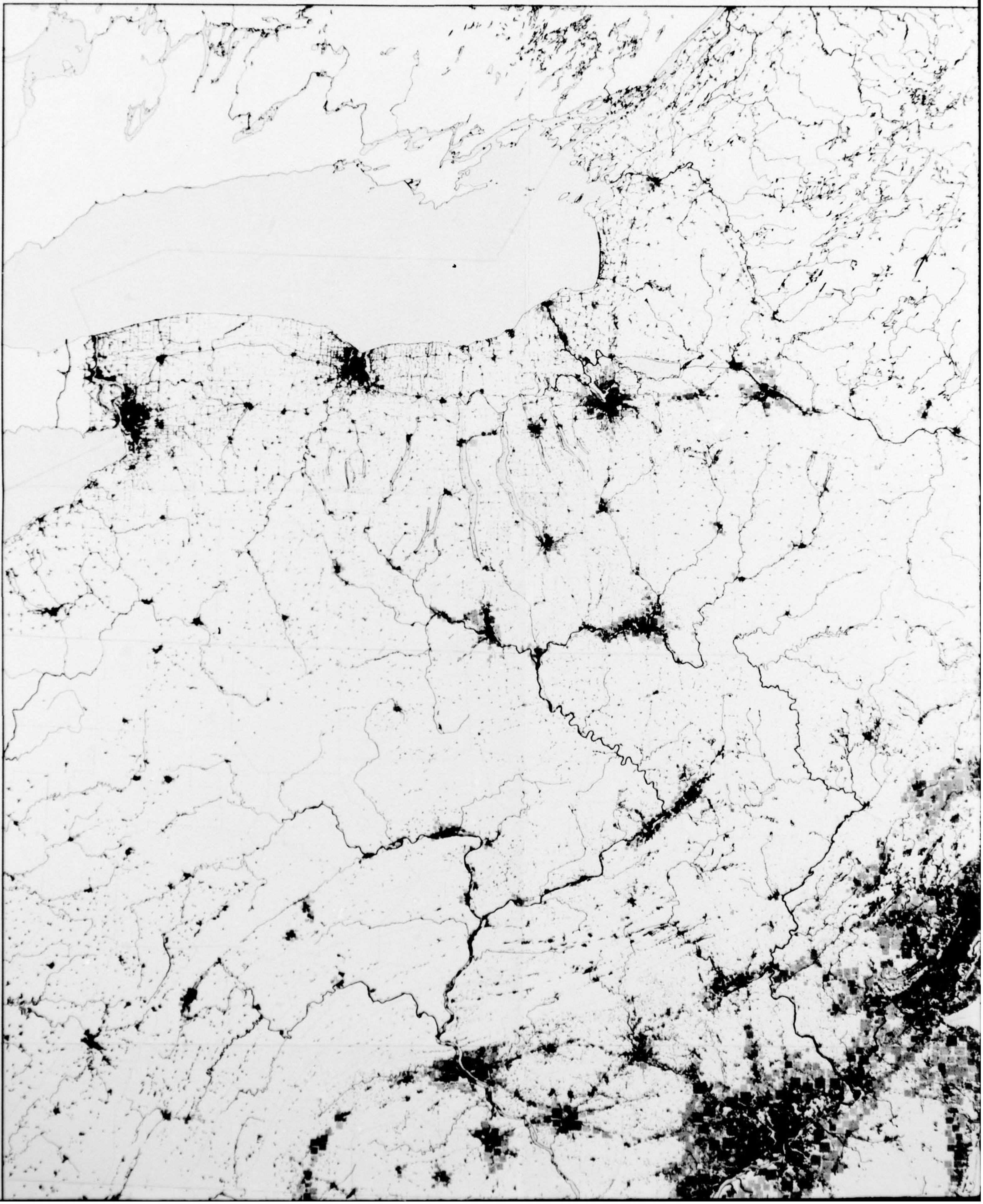

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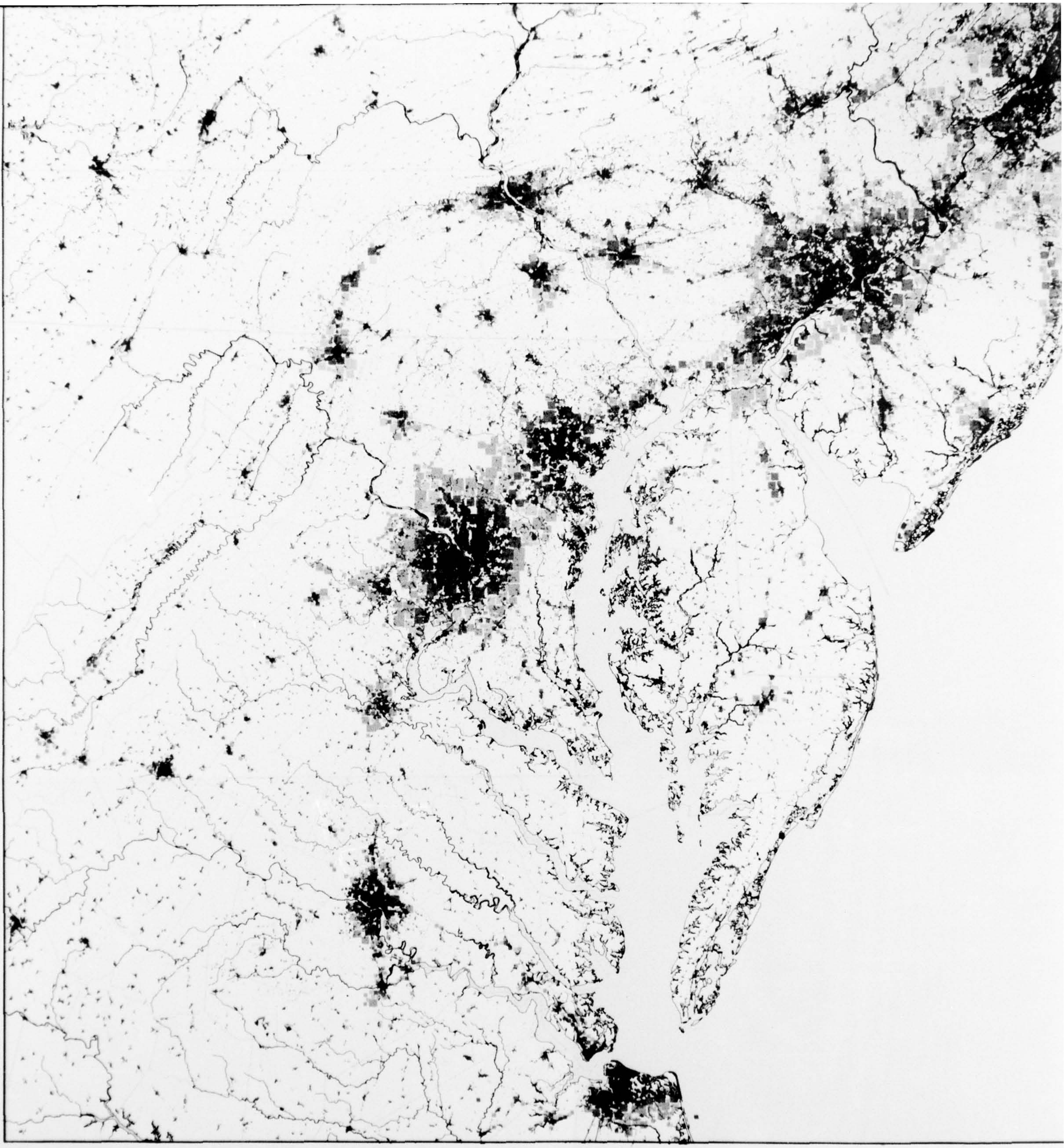

INTENSIVELY DEVELOPED LAND	1962
TOTAL DEVELOPED LAND	1980
TOTAL DEVELOPED LAND	2000
TOTAL DEVELOPED LAND	2020

3

NORTH ATLANTIC REGIONAL WATER RESOURCES STUDY

REGIONAL PLAN ASSOCIATION 1968

10 0 10 20 30 40 Miles
SCALE

FIGURE G-10

4